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ABSTRACT

The report presents a computer model for forecasting occupational shortages into the near future based on occupational data reported monthly by the Texas Employment Commission for the period January 1970 to July 1975 and on job openings listed in classified want ads from September 1974 to July 1975. The report describes the methodology of the occupational shortages forecasting model and the equations used in the model (least squares method), and describes the features of the computer program with respect to input requirements, computing sequence, and output descriptions. The model predicts occupational shortages by extrapolations of the calculated linear forecasting equations which approximate the nonlinear occupational data. The correlation analysis which shows (1) how well the forecasting line represents the actual data points and (2) the reliability of the prediction is also included. Appendix A of the report (78 pages) presents computer graphical representations of the forecasting model as it applies to 76 technical occupational areas covered in the various departmental course offerings of the James Connally Campus of Texas State Technical Institute. Appendix B (eight pages) provides the computer program of the forecasting model. (JR)

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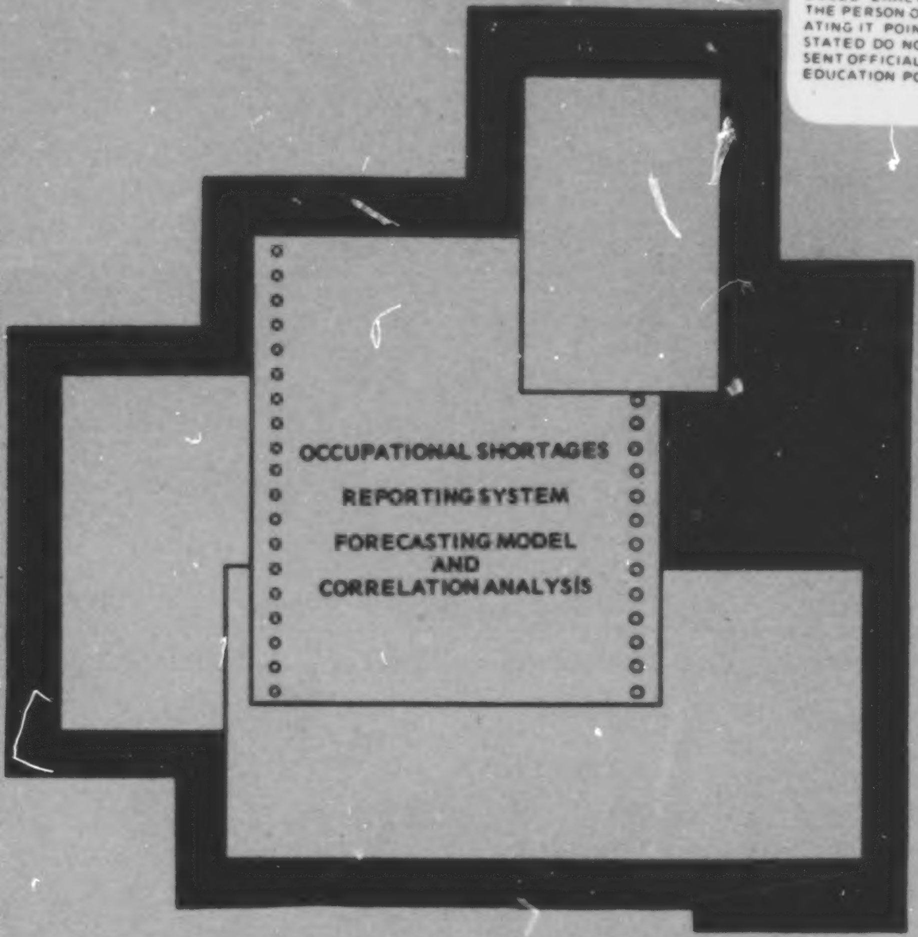

OCCUPATIONAL SHORTAGES REPORTING SYSTEM FORECASTING MODEL AND CORRELATION ANALYSIS

JAMES CONNALLY CAMPUS

TEXAS STATE TECHNICAL INSTITUTE

CE004 986

TEXAS STATE TECHNICAL INSTITUTE

WACO, TEXAS

OCCUPATIONAL SHORTAGES REPORTING SYSTEM FORECASTING MODEL & CORRELATION ANALYSIS

PREPARED FOR

MANPOWER RESEARCH

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July 1975

OCCUPATIONAL & EDUCATIONAL RESEARCH

PROCEDURE

TEXAS STATE TECHNICAL INSTITUTE

Subject	ACKNOWLEDGEMENTS	Department	OER
		Author	Theresa Park
		Date	July 1975
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Finally deep appreciation is expressed to Ms. Nancy Uptmore who neatly typed this report and helped with the proofreading.

ABSTRACT

A computerized graphical representation of the occupational shortages forecasting model and correlation analysis is presented. The methodology of occupational shortages forecasting model is discussed. The definitions of the terms and the equations used in this report are given. The features of the computer program used in this study are described in respect to the input requirement, computing sequence and the output description. Sample calculation of the forecasting model and the correlation analysis of the resulting model are shown in stepwise manner. Shown in the Appendix A are computer outputs of the graphical representation of this model and the analysis prepared for each department of the James Connally Campus of State Tech. Ths listing of the computer program is shown in Appendix B.

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In recent years, in order to reduce the uncertainty about future, many different forecasting methods are developed and applied to many areas such as job market and economic situations. But none of them is fully perfect and much criticism and doubt have been expressed with respect to methods as well as forecastability. Nevertheless, the forecasting has become a basic and necessary tool of decision making in modern society and is preferred over the unreliable and unsupported guesses.

Presented in this report is the occupational shortages forecasting model which is based on study of the historical data; that is the pattern of actual past event is projected into future by assuming that the trend which was true for the past will also be true for the future for the short-term period.

For the sake of simplicity and plausibility for short-term forecasting,(4) or lack of a better hypothesis, the least squares method of fitting first degree polynomial to the historical data is applied, thus resulting in the occupational shortages forecasting model.

Historical data available from the Occupational Shortages Reporting System(5) are those collected monthly from Texas Employment Commission (TEC) source for the period of January 1970 to the present (64 data points as of July 1975), and those from Classified Want-Ads source for the period of September 1974 to the present (10 data points as of July 1975).

The predictions are made by the extrapolation of calculated linear forecasting equation which may be considered an approximation to the unknown nonlinearity.

Included also in this report is the correlation analysis which shows how well the forecasting line represents the actual data points as well as the reliability of the prediction. The details of this analysis and method are described in Section I and Section III.

The objectives of this occupational shortages forecasting model and correlation analysis are to contribute in the following areas:

(1) The occupational outlook information to be used for vocational training, course planning and recruiting at the various departments of the James Connally Campus of State Tech.

(2) The feasibility study of new programs and ventures in terms of the marketability of skills that can be taught at State Tech.

(3) Knowledge of future demand of vocational occupations for the graduates of State Tech.

It may be added that we have found the following interesting trends in the actual data reported here:

(a) The slopes of the forecasting equations are, in a majority of the samples, positive in both cases of the TEC and the classified want-ads data.

(b) The classified want-ads data produced larger slopes in the forecasting equations and closer correlation in the analysis than the TEC data in many cases. This can be interpreted as indicating that the actual job shortages are probably greater than given by the TEC data.

SECTION I

THE METHODOLOGY OF FORECASTING MODEL, DEFINITIONS AND THE CORRELATION ANALYSIS

The methodology of various different forecasting techniques and the formulas used in the correlation analysis are given in the statistical literatures.(1),(2),(3),(4),(6) However, for completeness, and in order to define the terms as used in this present program, the equations are rederived and the definitions are restated here.

1. Least Squares Linear Approximation Method

This is the most widely used method for calculating the parameters a_i for the selected model. The principle will be explained with respect to the linear model

$$Y = a_0 + a_1X \quad . \qquad (1)$$

Given a table of N sets of data, where Y is estimated to be the above linear function of X, determine a_0 and a_1.

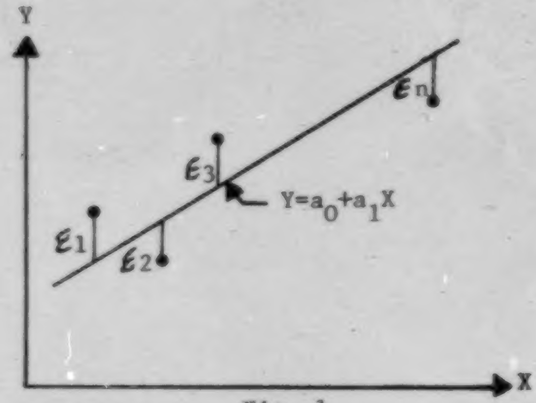


Fig. 1

The least squares criterion is to determine a_0 and a_1 such that the sum of the squares of the vertical distance between the data points and the straight line is a minimum. Referring to Fig. 1, this may be stated as:

$$\sum_{i=1}^{n} \epsilon_i{}^2 = \text{minimum} \quad .$$

This is true only if

$$\frac{\partial \sum_{i=1}^{n} \epsilon_i^2}{\partial a_0} = 0 ,$$

and

$$\frac{\partial \sum_{i=1}^{n} \epsilon_i^2}{\partial a_1} = 0 . \qquad (2)$$

The sum of ϵ_i^2 may be expressed in terms of the equation to be fitted and the original data points.

Referring to Fig. 1,

$$\epsilon = Y_{\text{estimated}} - Y_{\text{actual}}$$

$$Y_{\text{estimated}} = a_0 + a_1 X$$

$$Y_{\text{actual}} = Y .$$

Thus,

$$\begin{aligned} \epsilon_1 &= a_0 + a_1 X_1 - Y_1 \qquad (3) \\ \epsilon_2 &= a_0 + a_1 X_2 - Y_2 \\ &\vdots \\ \epsilon_n &= a_0 + a_1 X_n - Y_n \end{aligned}$$

and

$$\sum_{i=1}^{n} \epsilon_i^2 = (a_0 + a_1 X_1 - Y_1)^2 + (a_0 + a_1 X_2 - Y_2)^2 + \ldots\ldots + (a_0 + a_1 X_n - Y_n)^2 . \qquad (4)$$

Performing the differentiation given in Eq. (2) after substituting Eq. (4), it is obtained that

$$\left\{\begin{aligned} \frac{\partial \sum_{i=1}^{n} \epsilon_i^{\,2}}{\partial a_0} &= 2(a_0+a_1X_1-Y_1) + 2(a_0+a_1X_2-Y_2) + \ldots + 2(a_0+a_1X_n-Y_n) = 0 \;, \\ \frac{\partial \sum_{i=1}^{n} \epsilon_i^{\,2}}{\partial a_1} &= 2(a_0+a_1X_1-Y_1)X_1 + 2(a_0+a_1X_2-Y_2)X_2 + \ldots + 2(a_0+a_1X_n-Y_n)X_n = 0 \;, \end{aligned}\right. \tag{5}$$

which yield the following normal equations:

$$\left\{\begin{aligned} a_0 N \quad &+ a_1 \sum X = \sum Y \\ a_0 \sum X \quad &+ a_1 \sum X^2 = \sum XY \;. \end{aligned}\right. \tag{6}$$

Solving Eq. (6) for a_0 and a_1, we obtain

$$\begin{aligned} a_0 &= \frac{\begin{vmatrix} \sum Y & \sum X \\ \sum XY & \sum X^2 \end{vmatrix}}{\begin{vmatrix} N & \sum X \\ \sum X & \sum X^2 \end{vmatrix}} = \frac{(\sum Y)(\sum X^2) - (\sum X)(\sum XY)}{N\sum X^2 - (\sum X)^2} \;, \\ a_1 &= \frac{\begin{vmatrix} N & \sum Y \\ \sum X & \sum XY \end{vmatrix}}{\begin{vmatrix} N & \sum X \\ \sum X & \sum X^2 \end{vmatrix}} = \frac{N\sum XY - (\sum X)(\sum Y)}{N\sum X^2 - (\sum X)^2} \;. \end{aligned} \tag{7}$$

Therefore, the parameters a_0 and a_1 are computed in terms of sums and sums of cross products of the raw data.

2. Standard Deviation of the Variable Y

The standard deviation of a set of N numbers $Y_1, Y_2, \ldots, Y_N$ is denoted by s_Y and is defined by

$$s_Y = \sqrt{\frac{\sum_i^N (Y_i - \bar{Y})^2}{N}} = \sqrt{\frac{\sum_i^N y_i^2}{N}} = \sqrt{\frac{\sum_i^N Y_i^2 - N\bar{Y}^2}{N}}, \qquad (8)$$

where y_i represents the deviations of each of the numbers Y_i from the mean $\bar{Y}$. Thus s_Y is the root mean square of the deviations from the mean or, as it is sometimes called, the root mean square deviation.

3. Regression

Often, on the basis of sample data, we wish to estimate the value of a variable Y corresponding to a given value of a variable X. This can be accomplished by estimating the value of Y from a least square curve which fits the sample data. The resulting curve is called a regression curve of Y on X, since Y is estimated from X.

4. Standard Error of Estimate

If we let $Y_{est.}$ represent the value of Y for given values of X as estimated from Eq. (1), a measure of the scatter about the regression line of Y on X is supplied by the quantity

$$s_{Y.X} = \sqrt{\frac{\sum_i^N (Y_i - Y_{est.i})^2}{N}}, \qquad (9)$$

which is called the standard error of estimate of Y on X. Equation (9) can be written for the linear relationship as

$$s_{Y.X} = \sqrt{\frac{\sum_i^N Y_i^2 - a_0 \sum_i^N Y_i - a_1 \sum_i^N X Y_i}{N}}, \qquad (10)$$

which may be more suitable for computation.

5. Covariance of X and Y

If we let $x_i = X_i - \bar{X}$ and $y_i = Y_i - \bar{Y}$, then the covariance of X and Y is defined as

$$s_{XY} = \frac{\sum x_i y_i}{N} \qquad (11)$$

Using together the quantities defined as $s_X = \sqrt{\frac{\sum x_i^2}{N}}$, (standard deviation of the variable X), and $s_Y = \sqrt{\frac{\sum y_i^2}{N}}$, (standard deviation of the variable Y), the covariance of X and Y can be used to calculate the coefficient of correlation for the linear relationship as

$$r = \frac{s_{XY}}{s_X s_Y} \,. \qquad (12)$$

6. Statistical Hypotheses. Null Hypotheses

In attempting to reach decisions, it is useful to make assumptions or guesses about the populations involved. Such assumptions are called statistical hypotheses and in general are statements about the probability distributions of the populations. In many instances we formulate a statistical hypothesis for the sole purpose of rejecting or nullifying it. For example, if we want to decide whether one procedure is better than another, we formulate the hypothesis that there is no difference between the procedures (i.e., any observed differences are merely due to fluctuations in sampling from the same population). Such hypotheses are often called null hypotheses and are denoted by H_0.

7. Level of Significance

In testing a given hypothesis, the maximum probability with which we would be willing to risk a Type I error (hypothesis is rejected when it should be accepted) is called the level of significance of the test. In practice a level of significance of .05 or .01 is customary, although other values are used. If for example a .05 or 5% level of significance is chosen in designing a test of hypothesis, then there are about 5 chances in 100 that we would reject the hypothesis when it should be accepted, i.e., we are about 95% confident that we have made the right decision. In such case we say that the hypothesis has been rejected at a .05 level of significance, which means that we could be wrong with probability .05.

8. Coefficient of Correlation

The coefficient of correlation is a measure of the numerical closeness between the regression equation and the set of observed data points. That is, the coefficient of correlation is given by:

$$r = \pm \sqrt{\frac{\sum_i^N (Y_{est.i} - \bar{Y})^2}{\sum_i^N (Y_i - \bar{Y})^2}} \qquad (13)$$

If the relationship is linear, Eq. (13) can be expressed as:

$$r = \frac{N \sum_i^N X_i Y_i - \left(\sum_i^N X_i\right)\left(\sum_i^N Y_i\right)}{\sqrt{\left(N \sum_i^N X_i^2 - \left(\sum_i^N X_i\right)^2\right)\left(N \sum_i^N Y_i^2 - \left(\sum_i^N Y_i\right)^2\right)}} . \qquad (14)$$

The value of r varies between -1 and +1. If no correlation exists, the value will be 0. On the other hand, if a perfect correlation exists (i.e.,all the points fall on the regression line), the correlation will be 1. This value will be negative for inverse relationships.

If one is using regression/correlation analysis for application, he should be concerned about two requirements:

1. How well does the regression line represent the actual data points - or what is the coefficient of correlation?
2. How much confidence can be placed on this correlation measurement?

To satisfy the first requirement, the quantitative evaluation of the coefficient of correlation is necessary. Frequently, textbook authors present a general criterion for the evaluation of the significance of coefficients (2) as follows:

COEFFICIENT (r)	RELATIONSHIP
00 to ± .20	negligible
± .20 to ± .40	low or slight
± .40 to ± .60	moderate
± .60 to ± .80	substantial or marked
± .80 to ±1.00	high to very high

The foregoing is a crude analysis and may be somewhat misleading. The significance of a coefficient of correlation depends upon the nature of the factors related, the number of cases involved, the range of score data, and the purposes of the application of the measure. A more useful test of the significance of a coefficient of correlation is based upon probability theory and is illustrated next, to satisfy the second requirement. To test the significance of a coefficient of correlation, we may establish the null hypothesis (H_0) that $r = 0$, and that any value of r, other than 0, is the possible result of sampling error. To test the null hypothesis, we will use the t-test[2] here. The statistic, t, is calculated as:

$$t = r \sqrt{\frac{N - 2}{1 - r^2}} \qquad (15)$$

where

r = the correlation coefficient,

N = the number of samples used to derive the regression equation,

ν = N-2 is the degree of freedom,

and

t = the resulting number of standard errors of r in the interval between the computed r, r_c, and $r=0$.

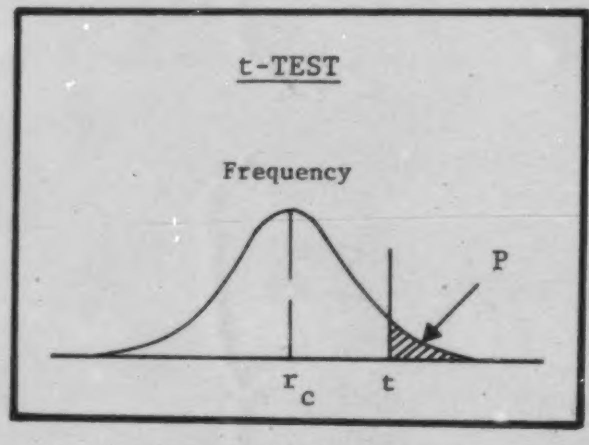


Fig. 2. The Student's t-test.

The cross hatched section, P is the probability that the correlation coefficient, r, equals zero (or will deviate t standard errors from r).

After calculating t, one can easiliy look up the probability value from a student's t-Table. This resulting probability is the probability that the coefficient of correlation equals zero. If the probability is significantly low, the null hypothesis is rejected, thus bolstering the reliability of the correlation coefficient. As an example, we consider a relationship with r = .90 and the number of samples, N, equals 11. To test whether the null hypothesis appears true, the statistic

$$t = 0.9 \sqrt{\frac{(11-2)}{1 - 0.9^2}} = 6.2 ,$$

which has student's t-distribution, is tested. From student's t-Table with ν = N-2=9 degrees of freedom, one obtains t = 2.82 at .01 level of significance. Since calculated t value is greater than 2.82, the probability that r = 0 for t = 6.2 and N=11 is less than 1%. Therefore, the null hypothesis, H_o, is rejected at a .01 level and the reliability of this given correlation coefficient is very good, with the probability of 99%.

SECTION II

COMPUTER PROGRAM FEATURES

Program JSOR0025

The features of computer program JSOR0025 include:

(1) reading of historical data points,
(2) calculation of least squares forecasting model,
(3) calculation of parameters involved in correlation analysis, and
(4) printing of the computed results in graphical form.

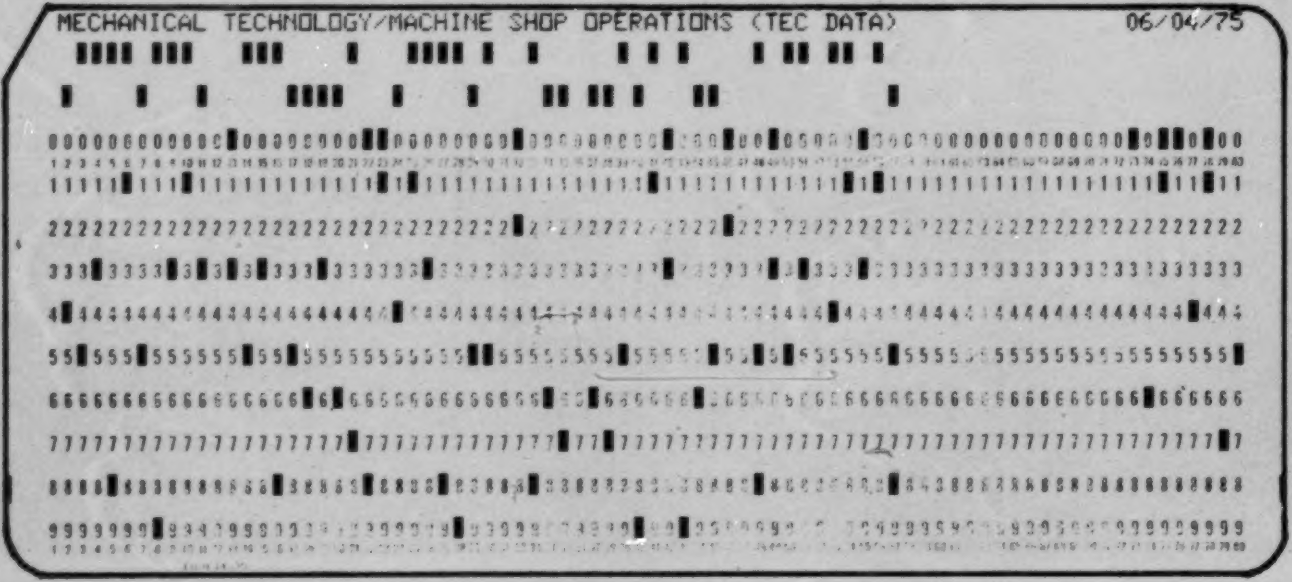
The historical data points are obtained from Occupational Shortages Master Data File$^{(5)}$, by summing up the monthly incidence of shortages in each input cluster, which consists of occupations closely related to the given technology. Program JSOR0025 is written in Fortran IV, Basic language and requires computing time of 33 seconds/graph with IBM 360/22 computer. The details of program features are further shown in Input Subsystem, Computer Subsystem and Output Subsystem next.

(a) Input Subsystem

CARD 1:	Title Card
NO. REQUIRED:	One card for each data set
FUNCTION:	Prints the title heading on top of each graph.

Column	Format	Variable	Description
1-72	18A4	TITLE(I)	Title to be printed on top of each graph
73-80	2A4	DATE	MM/DD/YY where MM=Month, DD=Day, YY=Year of run date

Sample Input of Title Card:



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MECHANICAL TECHNOLOGY/MACHINE SHOP OPERATIONS (TEC DATA)                06/04/75
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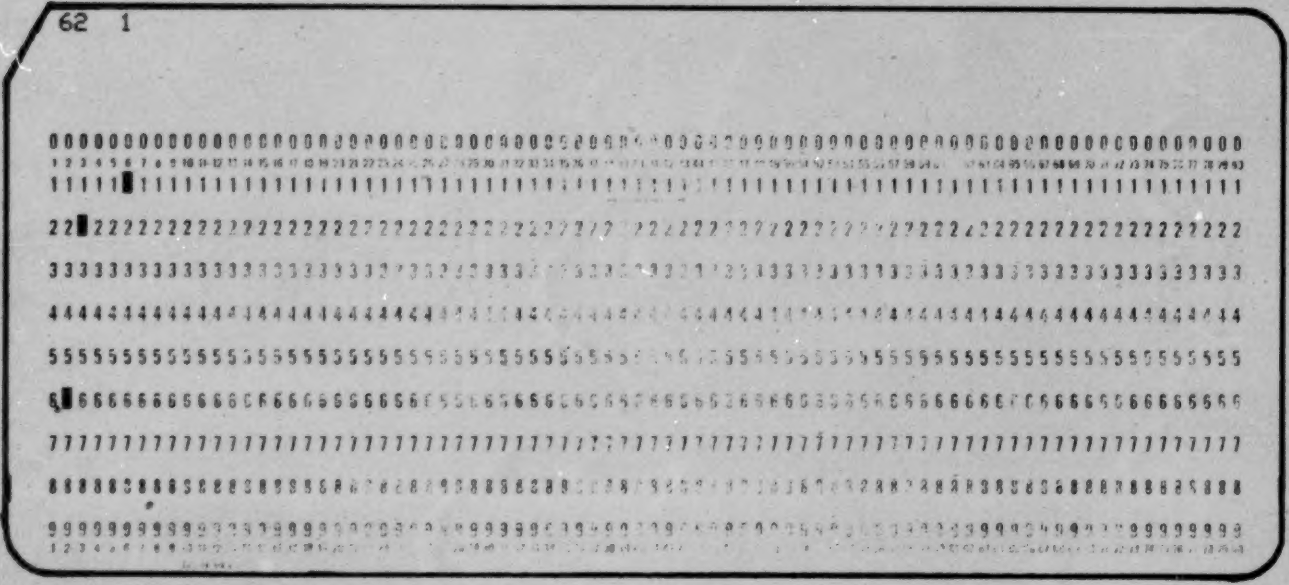
CARD 2: Control Card

NO. REQUIRED: One card for each data set

FUNCTION: Specifies the number of data points and the number of dependent variables

Column	Format	Variable	Description
1-3	I3	NP	Number of data points
4-6	I3	NC	Constant 1, which is the number of dependent variable for this program
7-10	A4	Blank	Blank field
11-80	none	none	Not used

Sample Input of Control Card:



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 62  1
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CARD 3: Data points card

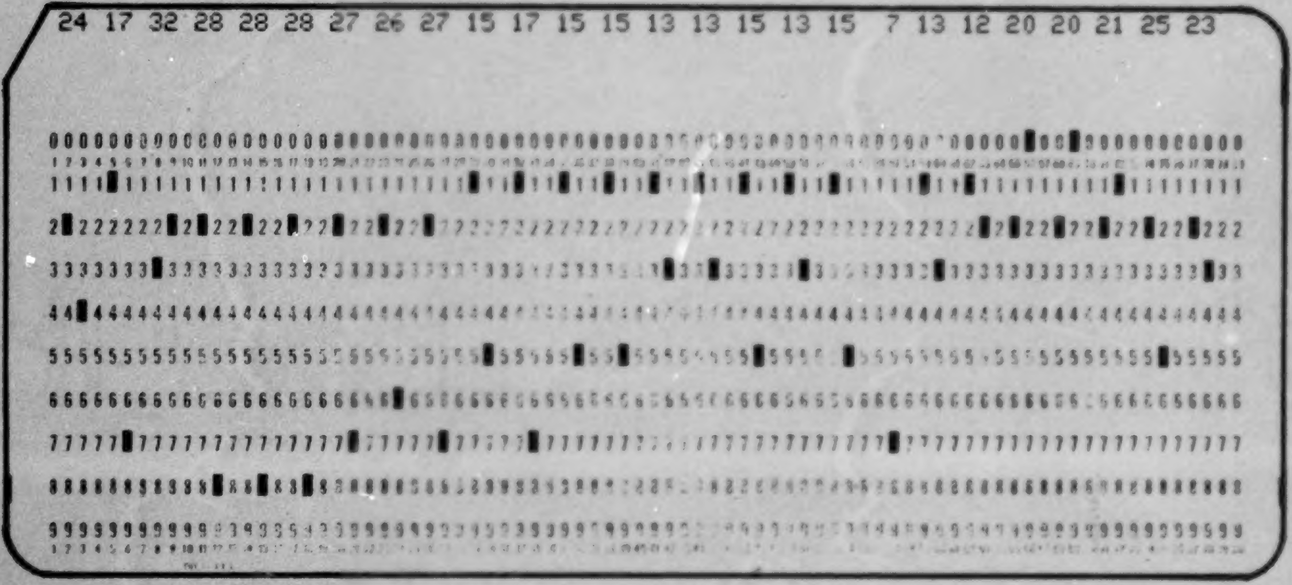
NO. REQUIRED: As many cards as necessary to input all the data points in twenty six points per card format.

FUNCTION: Defines magnitude of dependent variable in sequence, i.e., Y_1, Y_2, Y_3, ..., Y_n.

The magnitude of independent variable, $X_1 = 1$, $X_2=2$, $X_3=3$, ..., $X_n=n$ are generated by the program.

Column	Format	Variable	Description
1-78	26F3.0	Y(I)	Magnitude of dependent variable are given in twenty six consecutive fields, three columns each
79-80	none	none	Not used

Sample Input of Data Points Card:



24 17 32 28 28 28 27 26 27 15 17 15 15 13 13 15 13 15 7 13 12 20 20 21 25 23

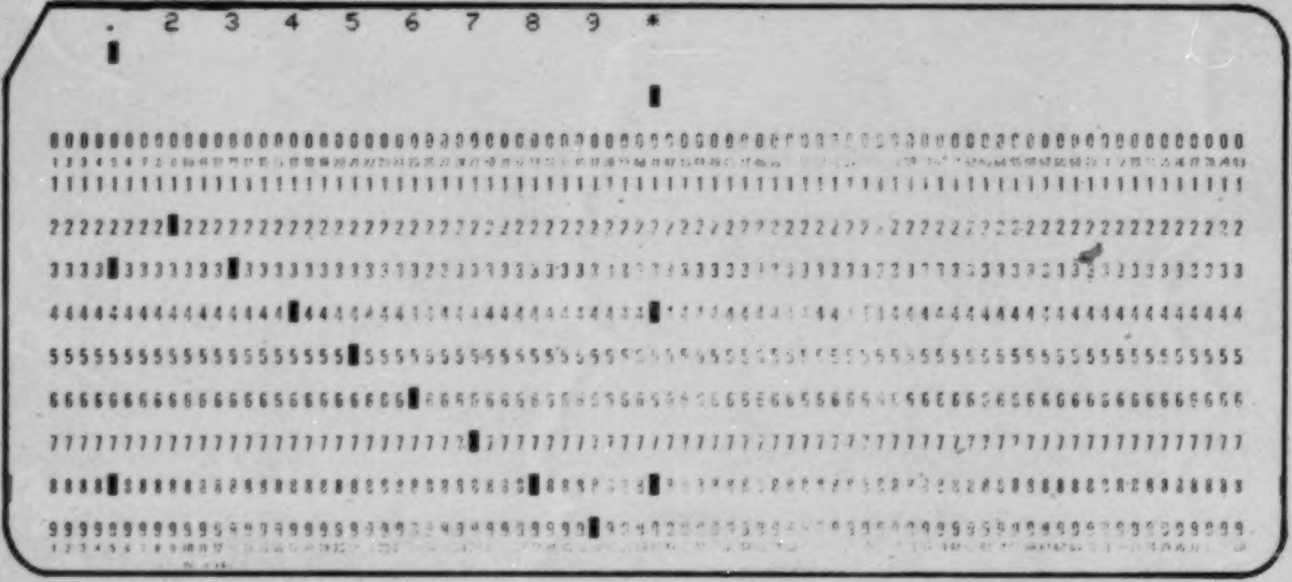
CARD 4: Plot Symbol Card

NO. REQUIRED: One card per data set

FUNCTION: Assigns plot symbols for plotting historical data and calculated data

Column	Format	Variable	Description
1-4	A4	KAR(1)	Blanks
5-8	A4	KAR(2)	Plot symbol in col. 5 for plotting historical data
9-40	8A4	KAR(3) to KAR(10)	Plot symbols for multiple plot (not used by this program)
41-44	A4	KAR(11)	Plot symbol in col. 41 for plotting calculated points
45-80	none	none	Not used

Sample Input of Plot Symbol Card:



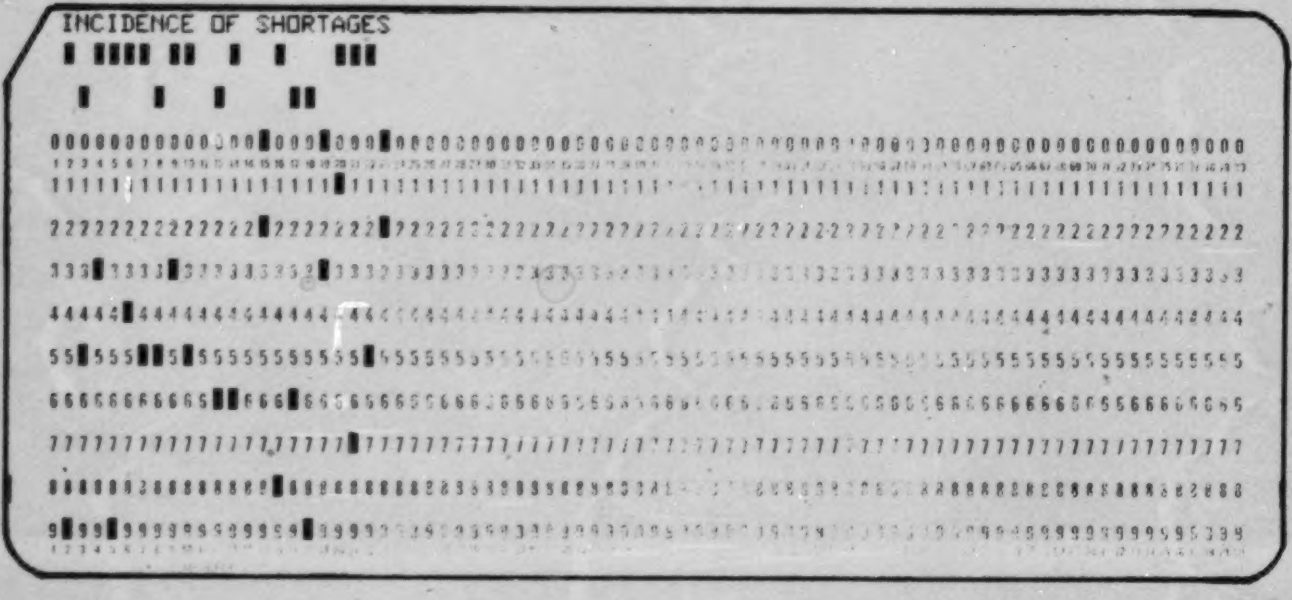
CARD 5: Y-Label Card

NO. REQUIRED: One card per data set

FUNCTION: Specifies the Y-label, which is to be printed vertically along the Y-axis

Column	Format	Variable	Description
1-40	40A1	YLABEL(I)	Y-label to be printed vertically along the Y-axis
41-80	none	none	Not used

Sample Input of Y-Label Card:



INCIDENCE OF SHORTAGES

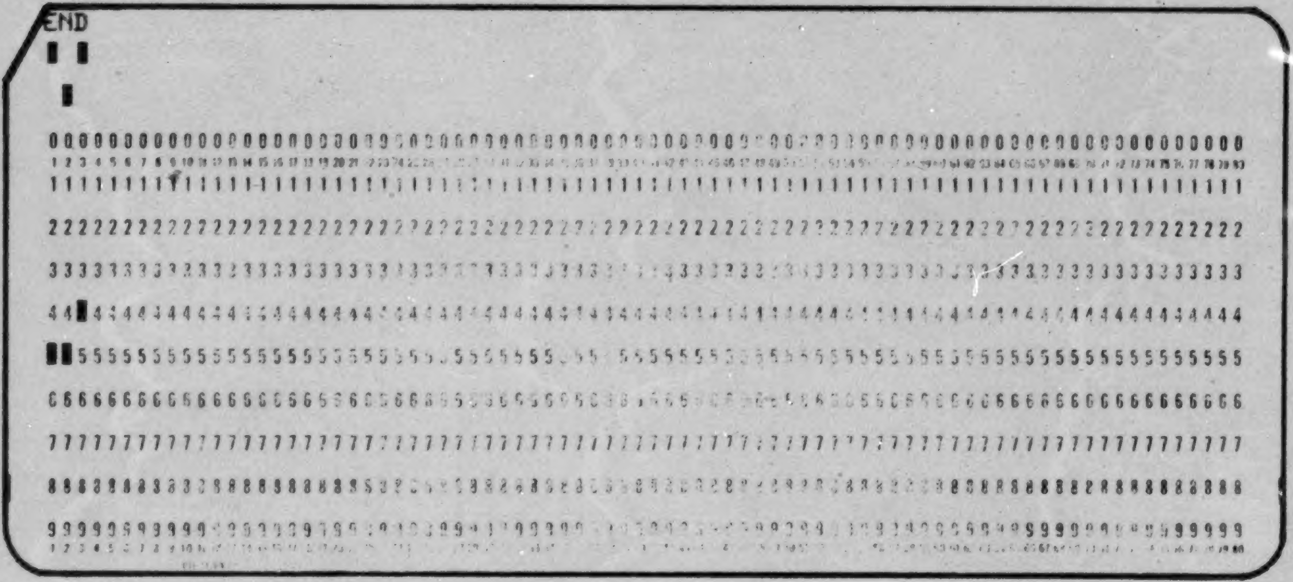
CARD 6: End-Card

NO. REQUIRED: One card per data set

FUNCTION: Terminates the runs by placing behind the last set of data

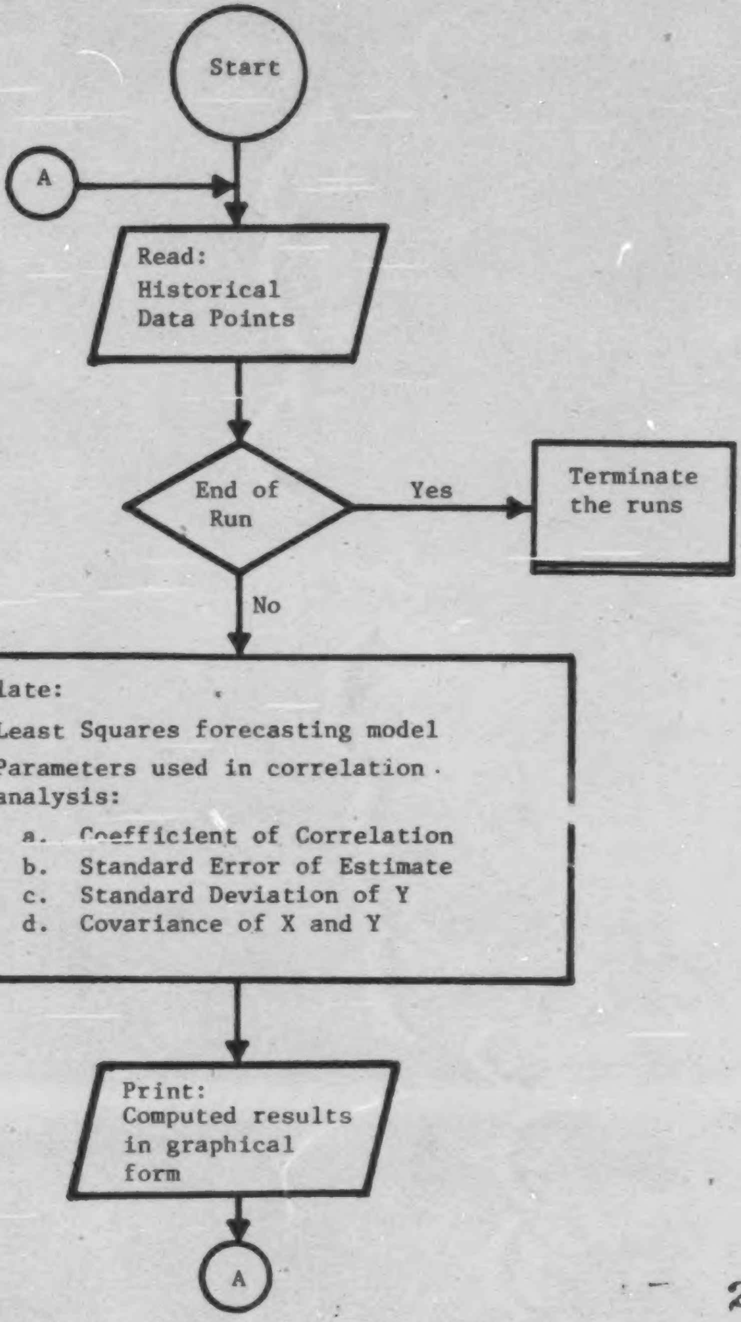
Column	Format	Variable	Description
1-3	A4	END	Constant 'END' in col 1-3 to terminate the runs
4-80	none	none	Not used

Sample Input of End-Card:



(b) Computer Subsystem

The computing sequence is shown below:


Start
A
Read:
Historical
Data Points
End of
Run
Yes
Terminate
the runs
No
Calculate:
1. Least Squares forecasting model
2. Parameters used in correlation analysis:
a. Coefficient of Correlation
b. Standard Error of Estimate
c. Standard Deviation of Y
d. Covariance of X and Y
Print:
Computed results
in graphical
form
A

(c) Output Subsystem

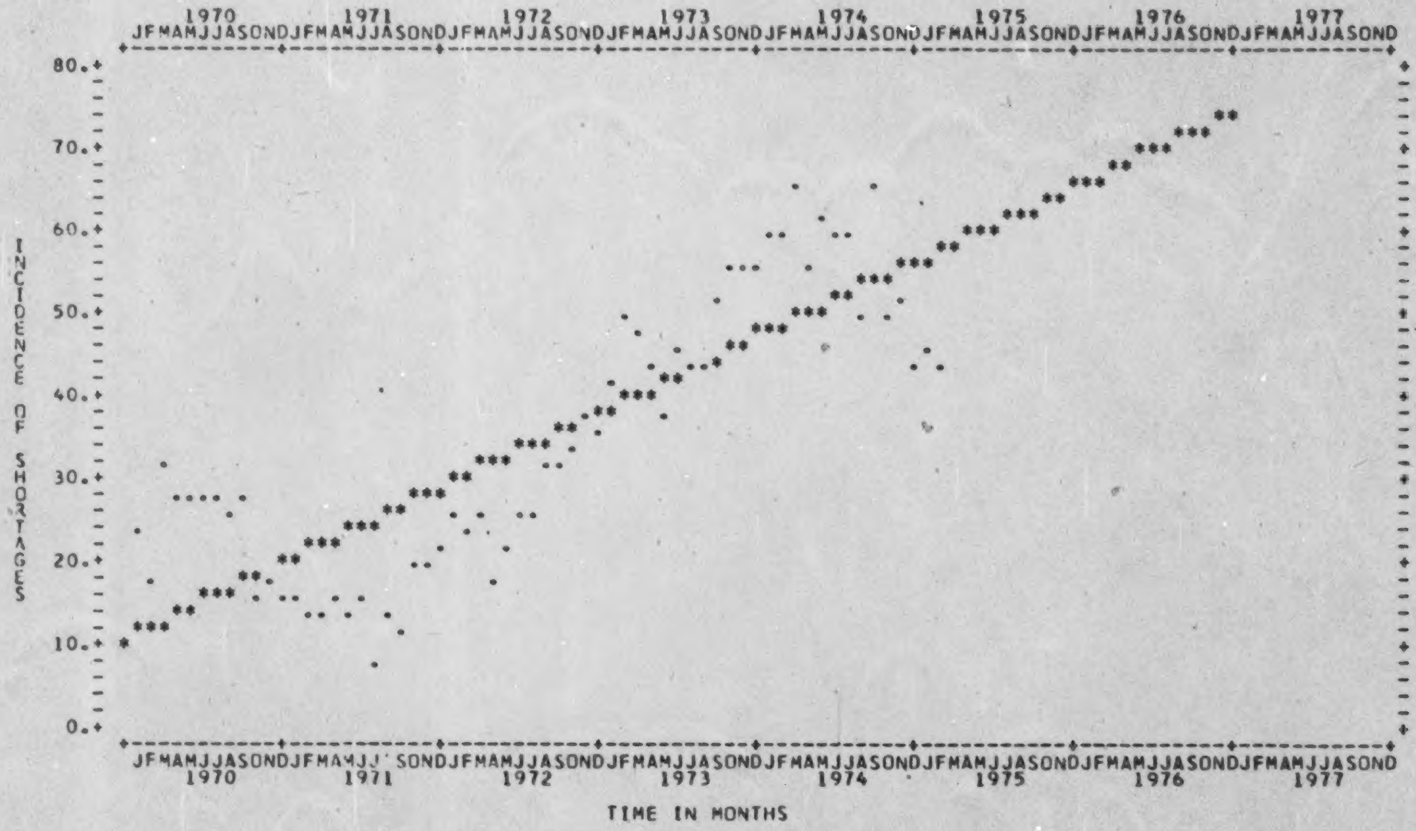
The computed results are shown in graphical form of X-Y plot. The title of the graph is shown at the top of the page. The axis of independent variable is marked in month, year sequence. The axis of dependent variable is the number of incidence of shortages. The historical data is shown with symbol, (.). The data calculated by least squares forecasting equation is shown with symbol, *. The impression of the staircase function of the calculated forecasting line is due to the limitation of line plotter which rounds the calculated point to the nearest integer. The exact form of the forecasting equation is given in the printed graphical output sheet. Other parameters calculated and printed are:

(1) coefficient of correlation,
(2) standard error of estimate,
(3) standard deviation of Y, and
(4) covariance of X and Y.

The sample output of this program is shown next.

SAMPLE OUTPUT OF COMPUTER GRAPHICAL REPRESENTATION OF FORECASTING MODEL AND CORRELATION ANALYSIS

MECHANICAL TECHNOLOGY/MACHINE SHOP OPERATIONS (TEC DATA)   06/04/75



```
LEAST SQUARES TREND LINE      Y      =   0.7598 * (X) + 10.5352      .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.8251                      *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    9.3
STANDARD DEVIATION OF Y       S(Y)   =  16.5
COVARIANCE OF X AND Y         S(XY)  = 243.3
```

SECTION III

SAMPLE CALCULATION OF FORECASTING MODEL AND ITS CORRELATION ANALYSIS

In order to illustrate the method of computing forecasting model and the parameters involved in the correlation analysis, the hand calculation is performed using the real input data of Mechanical Technology/Machine Shop Operations shortages which is also used in the computer processing of output. It is noted that the hand calculation results agree very well with the computer results.

The following table is constructed to aid the hand calculation. The dependent variable, Y is the incidence of shortages reported in Mechanical Technology/Machine Shop Operation; and X, the independent variable, is the time in sequence from January 1970 to February 1975, which is the time period of collected TEC data.

Table 1

X	Y	X^2	Y^2	XY	$X-\bar{X}$	$Y-\bar{Y}$
1	24	1	576	24	-30.5	-10.468
2	17	4	289	34	-29.5	-17.468
3	32	9	1024	96	-28.5	- 2.468
4	28	16	784	112	-27.5	- 6.468
5	28	25	784	140	-26.5	- 6.468
6	28	36	784	168	-25.5	- 6.468
7	27	49	729	189	-24.5	- 7.468
8	26	64	676	208	-23.5	- 8.468
9	27	81	729	243	-22.5	- 7.468
10	15	100	225	150	-21.5	-19.468
11	17	121	289	187	-20.5	-17.468
12	15	144	225	180	-19.5	-19.468
13	15	169	225	195	-18.5	-19.468
14	13	196	169	182	-17.5	-21.468
15	13	225	169	195	-16.5	-21.468
16	15	256	225	240	-15.5	-19.468
17	13	289	169	221	-14.5	-21.468
18	15	324	225	270	-13.5	-19.468
19	7	361	49	133	-12.5	-27.468
20	13	400	169	260	-11.5	-21.468
21	12	441	144	252	-10.5	-22.468
22	20	484	400	440	- 9.5	-14.468
23	20	529	400	460	- 8.5	-14.468

Table 1
(continued)

X	Y	X^2	Y^2	XY	$X-\bar{X}$	$Y-\bar{Y}$
24	21	576	441	504	- 7.5	-13.468
25	25	625	625	625	- 6.5	- 9.468
26	23	676	529	598	- 5.5	-11.468
27	26	729	676	702	- 4.5	- 8.468
28	18	784	324	504	- 3.5	-16.468
29	21	841	441	609	- 2.5	-13.468
30	25	900	625	750	- 1.5	- 9.468
31	26	961	676	806	- 0.5	- 8.468
32	31	1024	961	992	0.5	- 3.468
33	31	1089	961	1089	1.5	- 3.468
34	33	1156	1089	1122	2.5	- 1.468
35	37	1225	1369	1295	3.5	2.532
36	35	1296	1225	1260	4.5	0.5322
37	42	1369	1764	1554	5.5	7.532
38	49	1444	2401	1862	6.5	14.532
39	48	1521	2304	1872	7.5	13.532
40	43	1600	1849	1720	8.5	8.532
41	38	1681	1444	1558	9.5	3.532
42	46	1764	2116	1932	10.5	11.532
43	44	1849	1936	1892	11.5	9.532
44	44	1936	1936	1936	12.5	9.532
45	52	2025	2704	2340	13.5	17.532
46	56	2116	3136	2576	14.5	21.532
47	56	2209	3136	2632	15.5	21.532
48	56	2304	3136	2688	16.5	21.532
49	59	2401	3481	2891	17.5	24.532
50	60	2500	3600	3000	18.5	25.532
51	66	2601	4356	3366	19.5	31.532
52	56	2704	3136	2912	20.5	21.532
53	62	2809	3844	3286	21.5	27.532
54	59	2916	3481	3186	22.5	24.532
55	59	3025	3481	3245	23.5	24.532
56	50	3136	2500	2800	24.5	15.532
57	66	3249	4356	3762	25.5	31.532
58	50	3364	2500	2900	26.5	15.532
59	51	3481	2601	3009	27.5	16.532
60	44	3600	1936	2640	28.5	9.532
61	45	3721	2025	2745	29.5	10.532
62	44	3844	1936	2728	30.5	9.532
$\Sigma X=1,953$	$\Sigma Y=2,137$	$\Sigma X^2=81,375$	$\Sigma Y^2=90,495$	$\Sigma XY=82,401$	$\Sigma(X-\bar{X})(Y-\bar{Y})=15085.4929$	

$\bar{X} = 1,953/62=31.5$

$\bar{Y} = 2,137/62=34.4677$

(1) The coefficients a_0, a_1 of the regression line (forecasting model) are computed by Eq. (7) as follows:

$$\text{Let DET} = N \sum X^2 - (\sum X)^2$$

$$= 62(81{,}375) - 1{,}953^2$$

$$= 1{,}231{,}041.$$

Then,

$$a_0 = \{(\sum Y)(\sum X^2) - (\sum X)(\sum XY)\}/\text{DET}$$

$$= \{(2{,}137)(81{,}375) - 1{,}953(82{,}401)\}/1{,}231{,}041$$

$= 10.53517$ (10.5352, computer result),

and,

$$a_1 = \{N \sum XY - (\sum X)(\sum Y)\}/\text{DET}$$

$$= \{62(82{,}401) - 1{,}953(2{,}137)\}/1{,}231{,}041$$

$= .75976$ (.7598, computer result).

Therefore, the resulting forecasting equation is, by Equation (1),

$$Y = .7598\ X + 10.5352.$$

(2) The standard error of estimate is calculated by Equation (10) as:

$$s_{Y.X} = \sqrt{\frac{\sum Y^2 - a_o \sum Y - a_1 \sum XY}{N}}$$

$$= \sqrt{\frac{90{,}495-10.53517(2{,}137)-.75976(82{,}401)}{62}}$$

$$= \sqrt{86.7155}$$

$$= 9.31 \quad (\underline{9.3}, \text{ computer result}).$$

(3) The standard deviation of the variable Y is computed by Equation (8) as:

$$s_Y = \sqrt{\frac{\sum Y^2 - N\bar{Y}^2}{N}}$$

$$= \sqrt{\frac{90{,}495-62(34.46774)^2}{62}}$$

$$= \sqrt{271.5716}$$

$$= 16.479 \quad (\underline{16.5}, \text{ computer result}).$$

(4) The covariance of X and Y is computed by Equation (1'),

$$s_{XY} = \frac{\sum (X - \bar{X})(Y - \bar{Y})}{N}$$

$$= \frac{15{,}085.4929}{62}$$

$$= 243.314 \quad (\underline{243.3}, \text{ computer result}).$$

(5) The coefficient of correlation, r, is calculated by Equation (14) as:

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\left\{N\sum X^2 - (\sum X)^2\right\}\left\{N\sum Y^2 - (\sum Y)^2\right\}}}$$

$$= \frac{62(82{,}401) - 1{,}953(2{,}137)}{\sqrt{\left\{62(81{,}375)-1{,}953^2\right\}\left\{62(90{,}495)-2{,}137^2\right\}}}$$

$= .82505$ (.8251, computer result).

(6) t-Test is performed as follows:

Let the null hypothesis, H_0, be given as

H_0 : The coefficient of correlation, r, equals zero and that any value of r, other than 0, is the possible result of sampling error.

To test the null hypothesis, the statistic, t, is calculated by Equation (15),

$$t = r\sqrt{\frac{N-2}{1-r^2}}$$

$$= .8251\sqrt{\frac{62-2}{1-.8251^2}}$$

$$= 11.31 .$$

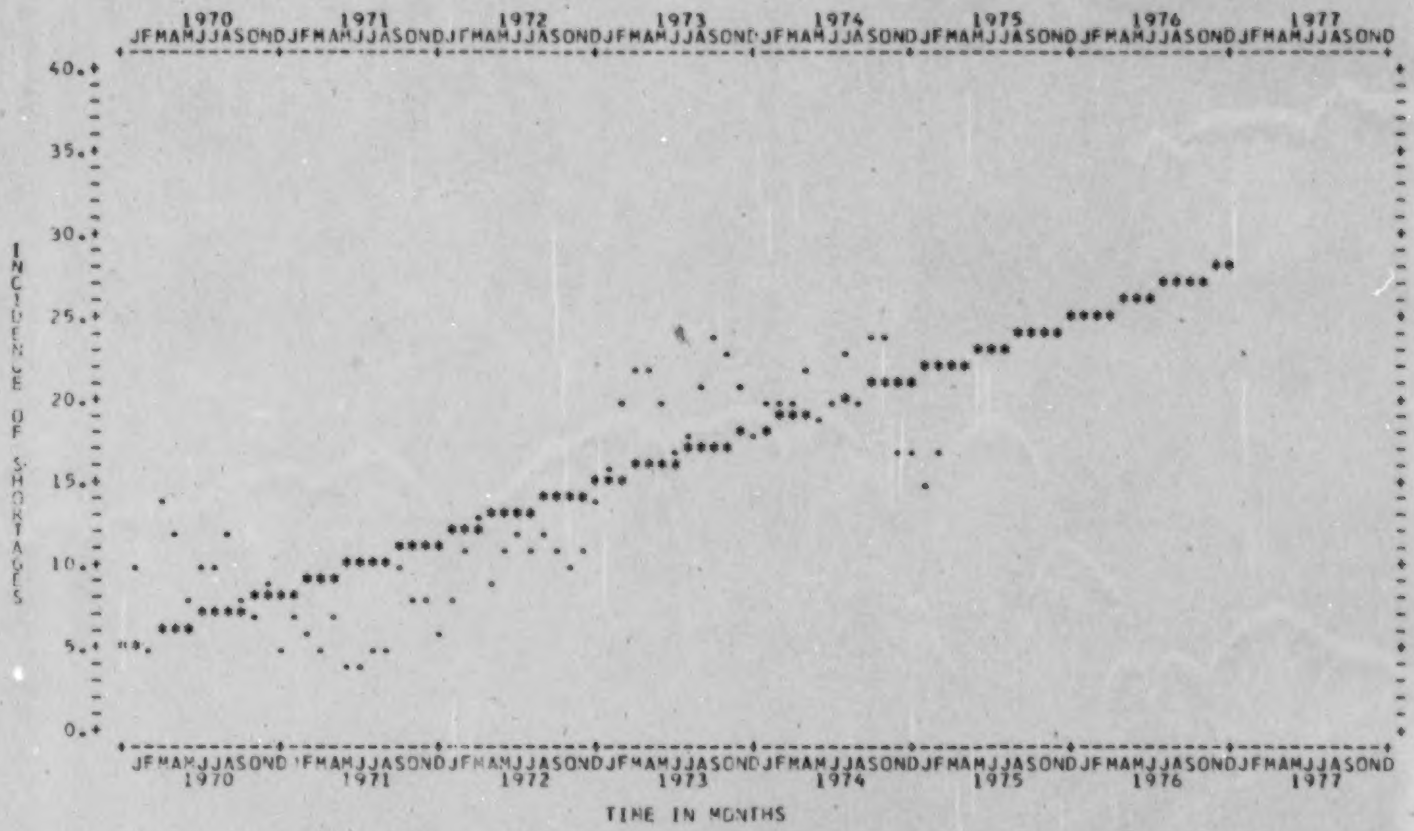
By looking up the Student's t-Table, and choosing the level of significance to be .01, we would reject H_0 if $t > t_{.99} = 2.39$ for $(62 - 2) = 60$ degrees of freedom. (See Figure 2 on Page 11).

Thus, the null hypothesis is rejected at a .01 level of significance and the relationship between the forecasting model and the set of occupational shortages data points of Mechanical Technology/Machine Shop Operations is quite sound.

APPENDIX A.

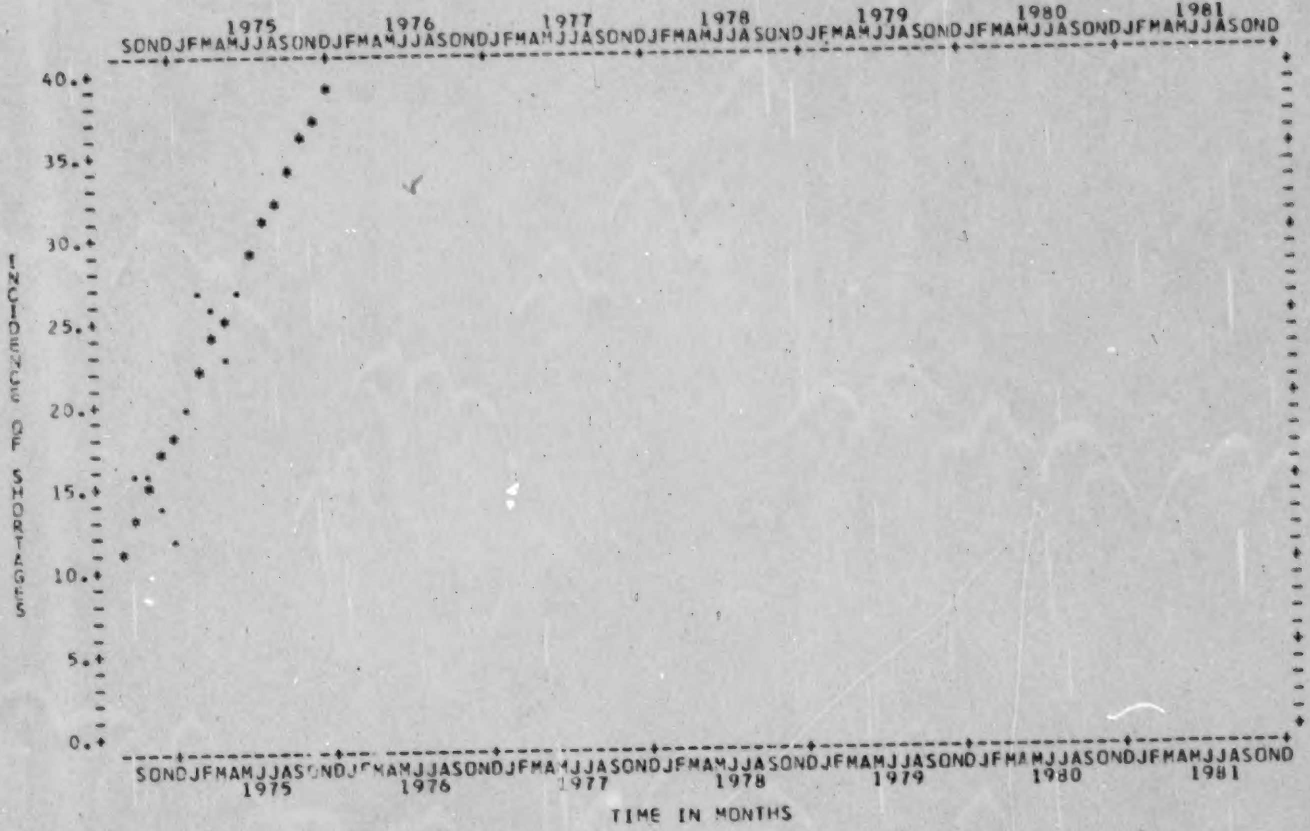
COMPUTER GRAPHICAL REPRESENTATIONS OF FORECASTING MODEL AND ANALYSIS PREPARED FOR THE VARIOUS DEPARTMENTS OF THE JAMES CONNALLY CAMPUS OF STATE TECH

ADVANCED TECHNOLOGY CLUSTER (TEC DATA)   06/05/75



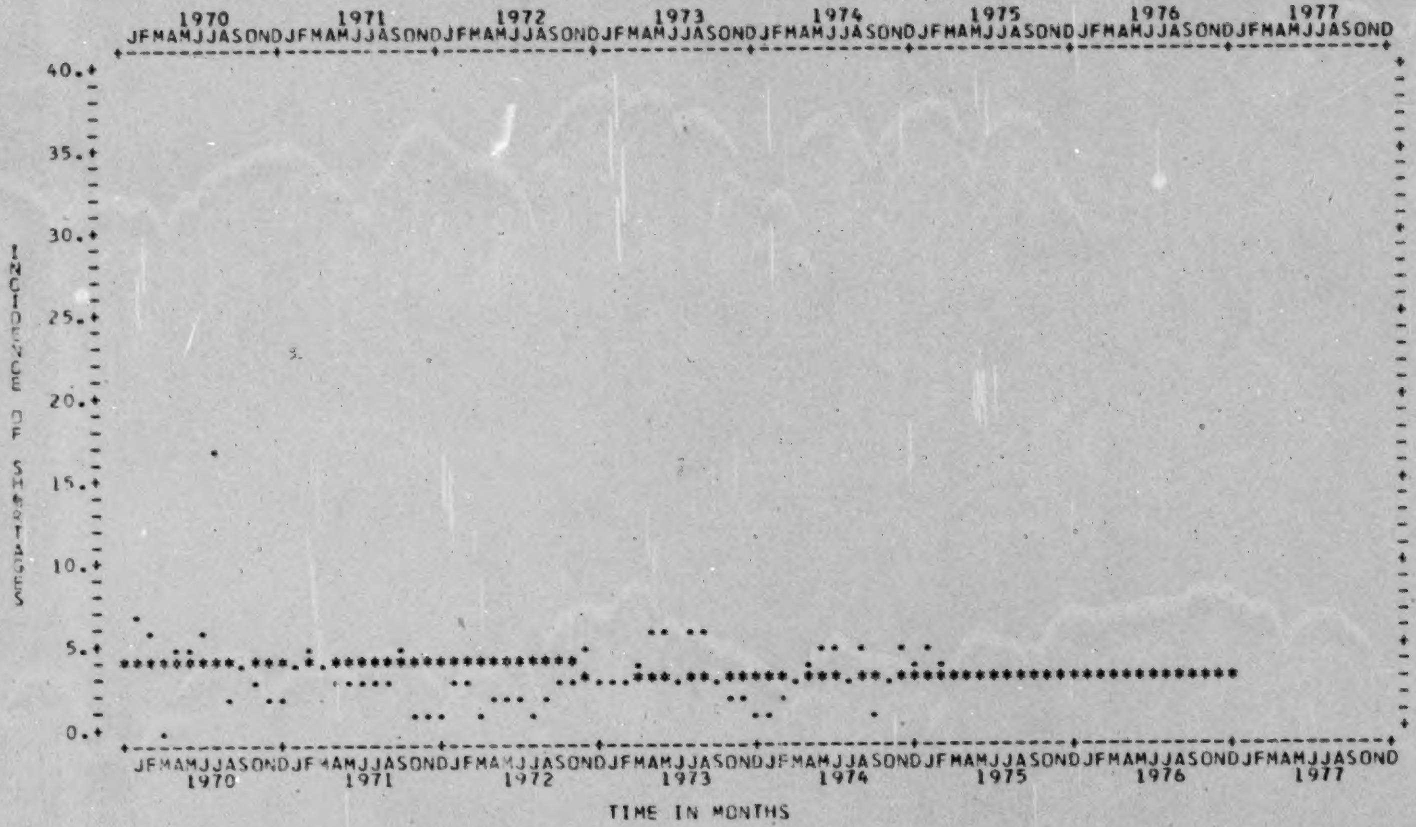
```
LEAST SQUARES TREND LINE      Y      =   0.2747 * (X) +  4.8620          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.8004                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    3.7
STANDARD DEVIATION OF Y       S(Y)   =   6.1
COVARIANCE OF X AND Y         S(XY)  =  88.0
```

ADVANCED TECHNOLOGY (CLASSIFIED WANT-ADS DATA)   07/07/75



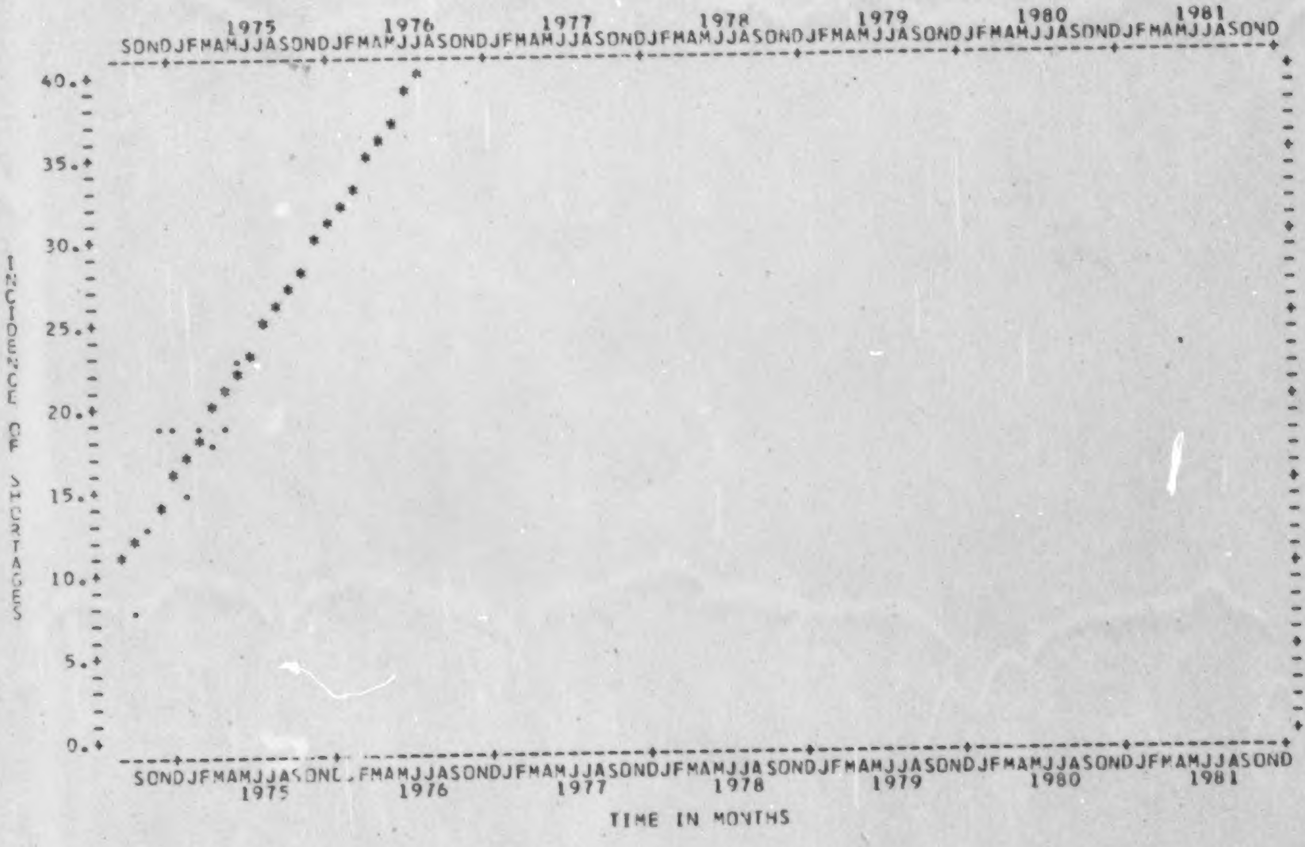
```
LEAST SQUARES TREND LINE      Y      =     1.7333 * (X) + 11.4444          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =     0.8098                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=      3.2
STANDARD DEVIATION OF Y       S(Y)   =     5.5
COVARIANCE OF X AND Y         S(XY)  =    11.6
```

ANIMAL TECHNOLOGY CLUSTER (TEC DATA)   06/02/75



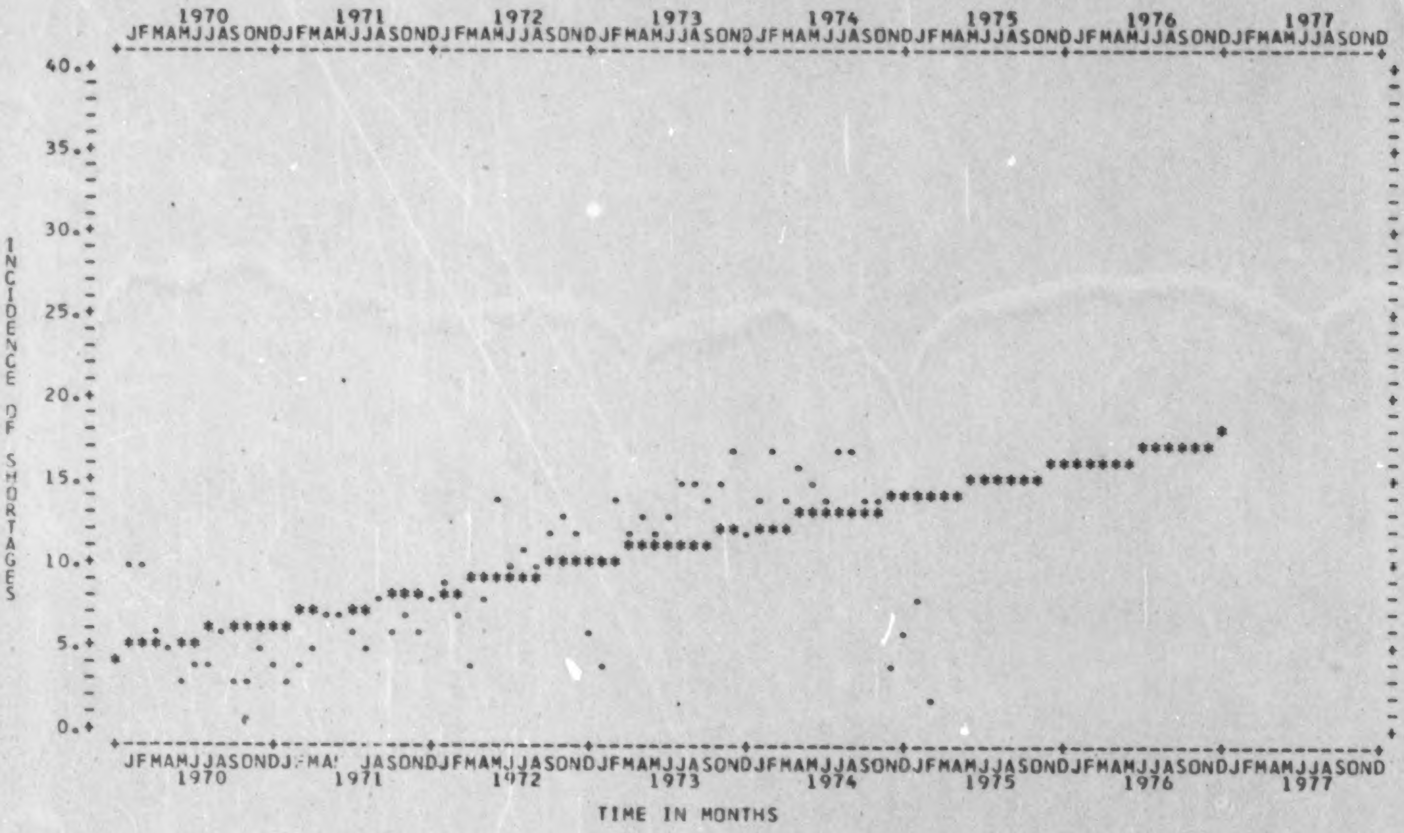
```
LEAST SQUARES TREND LINE      Y      =  -0.0167 * (X) +  4.0735          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =  -0.1264                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    2.3
STANDARD DEVIATION OF Y       S(Y)  =    2.4
COVARIANCE OF X AND Y         S(XY) =   -5.3
```

ANIMAL TECHNOLOGY CLUSTER (CLASSIFIED WANT-ADS DATA)   07/07/75



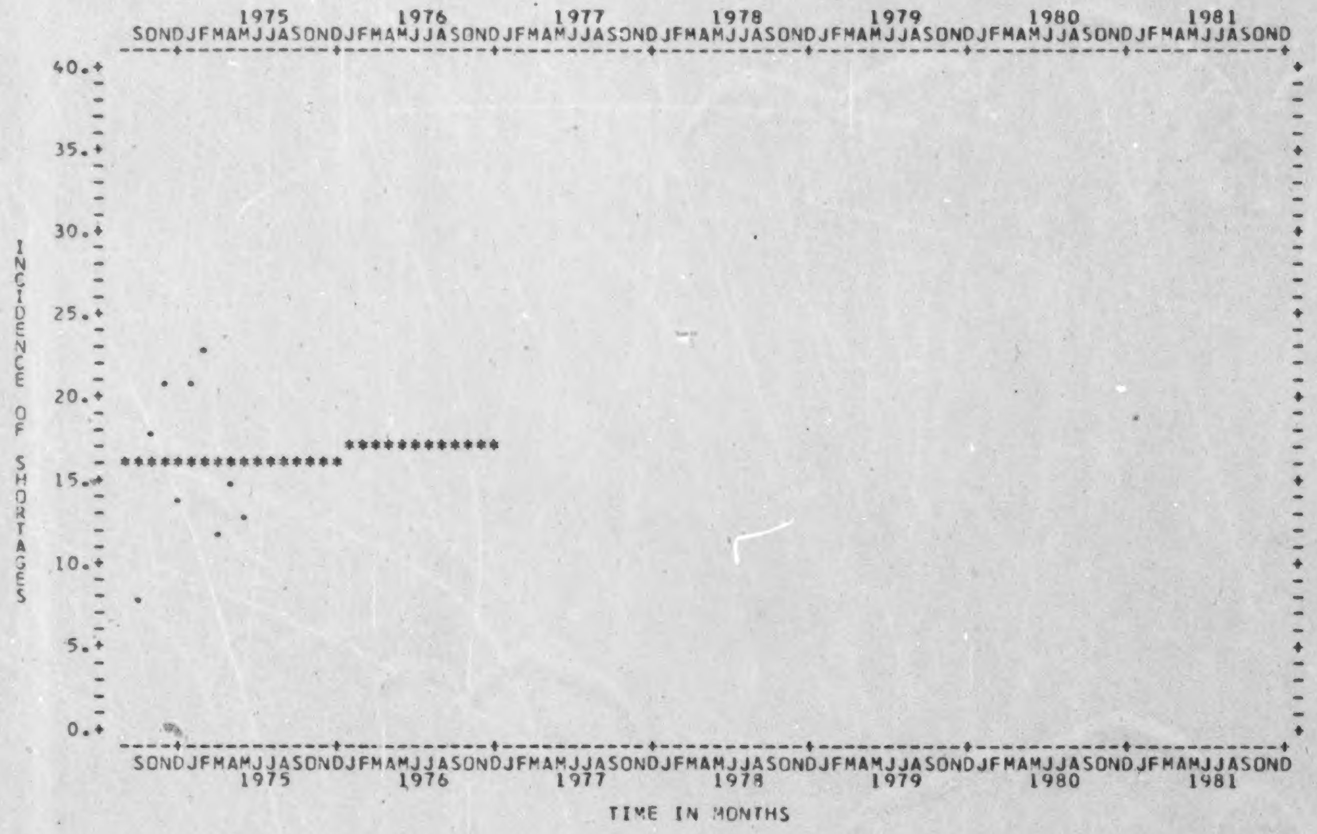
```
LEAST SQUARES TREND LINE       Y      =   1.2667 * (X) + 10.6667         :  = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R      =   0.7906                         *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=    2.5
STANDARD DEVIATION OF Y        S(Y)   =   4.1
COVARIANCE OF X AND Y          S(XY)  =   8.4
```

ARCHITECTURAL DRAWING CLUSTER (TEC DATA) 06/02/75



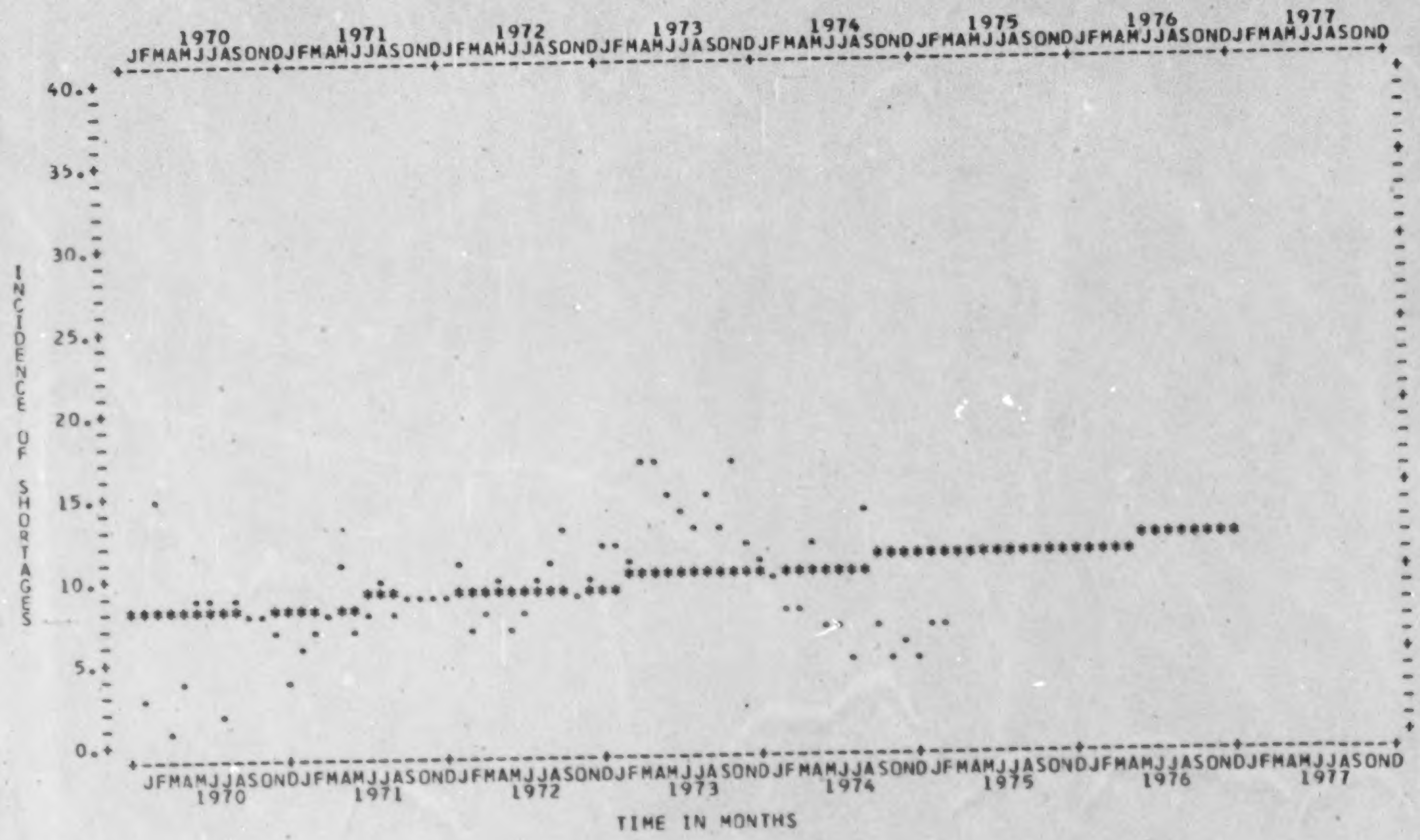
```
LEAST SQUARES TREND LINE      Y       =   0.1563 * (X) +  4.4167        .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R       =   0.6208                        *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=     3.5
STANDARD DEVIATION OF Y       S(Y)    =   4.5
COVARIANCE OF X AND Y         S(XY)   =  50.0
```

```
ARCHITECTURAL DRAWING CLUSTER (CLASSIFIED WANT-ADS DATA)          07/09/75
```



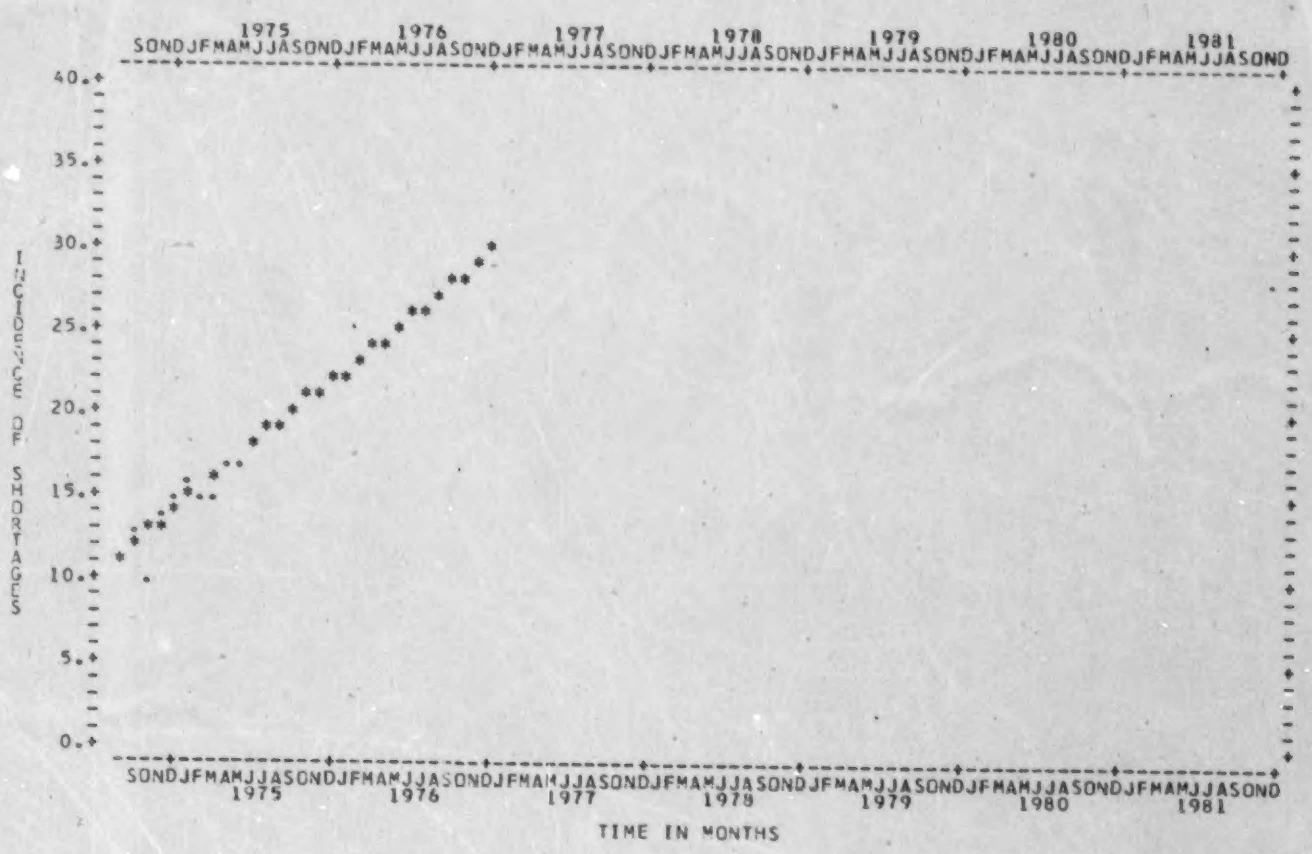
```
LEAST SQUARES TREND LINE      Y      =   0.0333 * (X) + 15.9444          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.0184                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    4.7
STANDARD DEVIATION OF Y       S(Y)   =   4.7
COVARIANCE OF X AND Y         S(XY)  =   0.2
```

AUTO BODY REPAIRMAN CLUSTER (TEC DATA)   06/09/75



```
LEAST SQUARES TREND LINE        Y       =   0.0512 * (X) +  7.5955      .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION      R       =   0.2602                      *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE      S(Y.X)=     3.4
STANDARD DEVIATION OF Y         S(Y)    =   3.5
COVARIANCE OF X AND Y.          S(XY) =    16.4
```

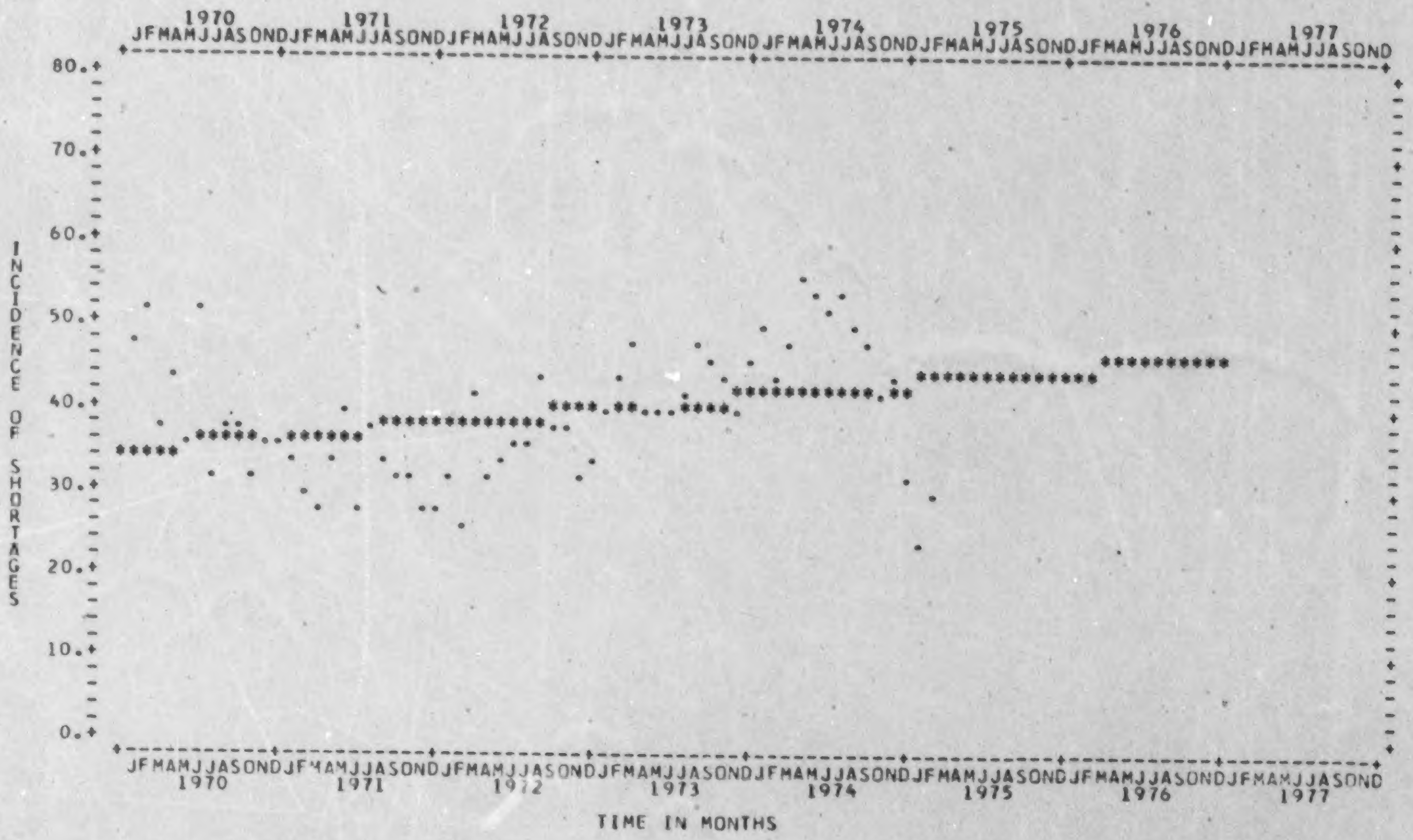
AUTO BODY REPAIRMAN CLUSTER (CLASSIFIED WANT-ADS DATA) 07/07/75



```
LEAST SQUARES TREND LINE       Y       =   0.6500 * (X) + 11.4167
COEFFICIENT OF CORRELATION     R       =   0.8168
STANDARD ERROR OF ESTIMATE     S(Y.X)=     1.2
STANDARD DEVIATION OF Y        S(Y)   =    2.1
COVARIANCE OF X AND Y          S(XY)  =    4.3
```

```
: = HISTORY OF DATA
* = CALCULATED DATA
```

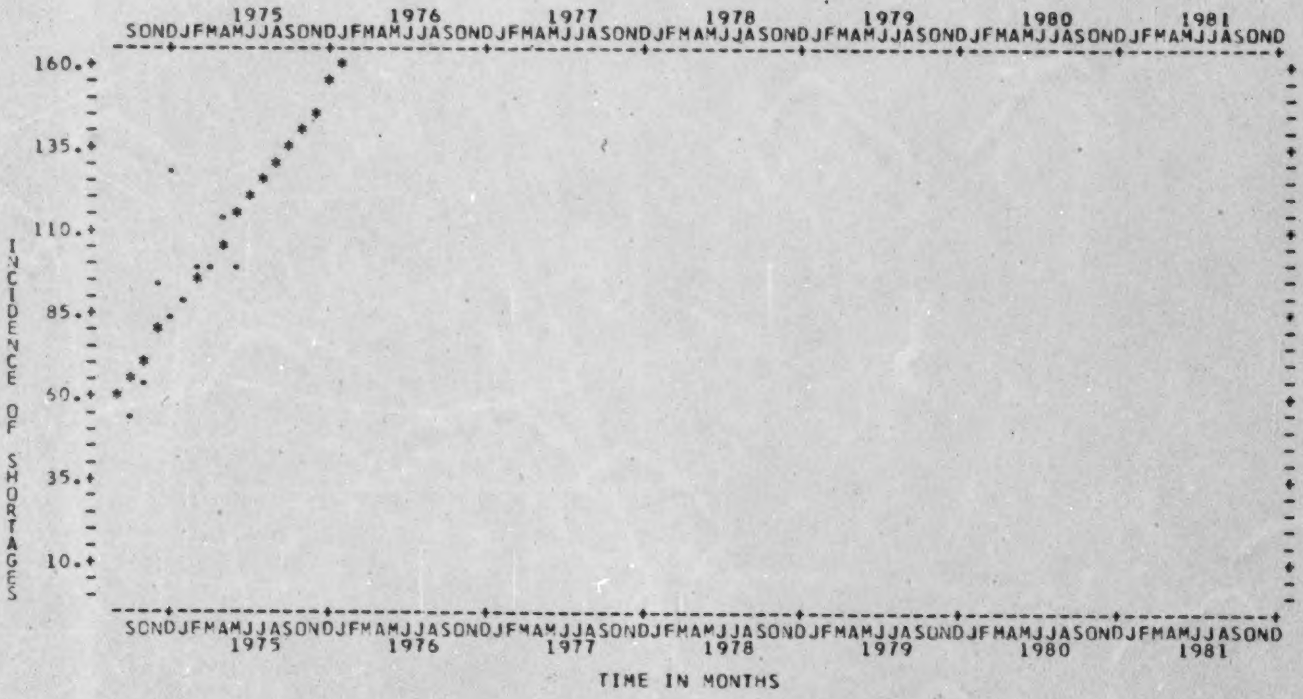
AUTOMATIC MERCHANDISING (TEC DATA)   06/04/75



```
LEAST SQUARES TREND LINE      Y      =   0.1426 * (X) + 34.3643
COEFFICIENT OF CORRELATION    R      =   0.3306
STANDARD ERROR OF ESTIMATE    S(Y.X)=    7.3
STANDARD DEVIATION OF Y       S(Y)   =   7.7
COVARIANCE OF X AND Y         S(XY)  =  45.7
```

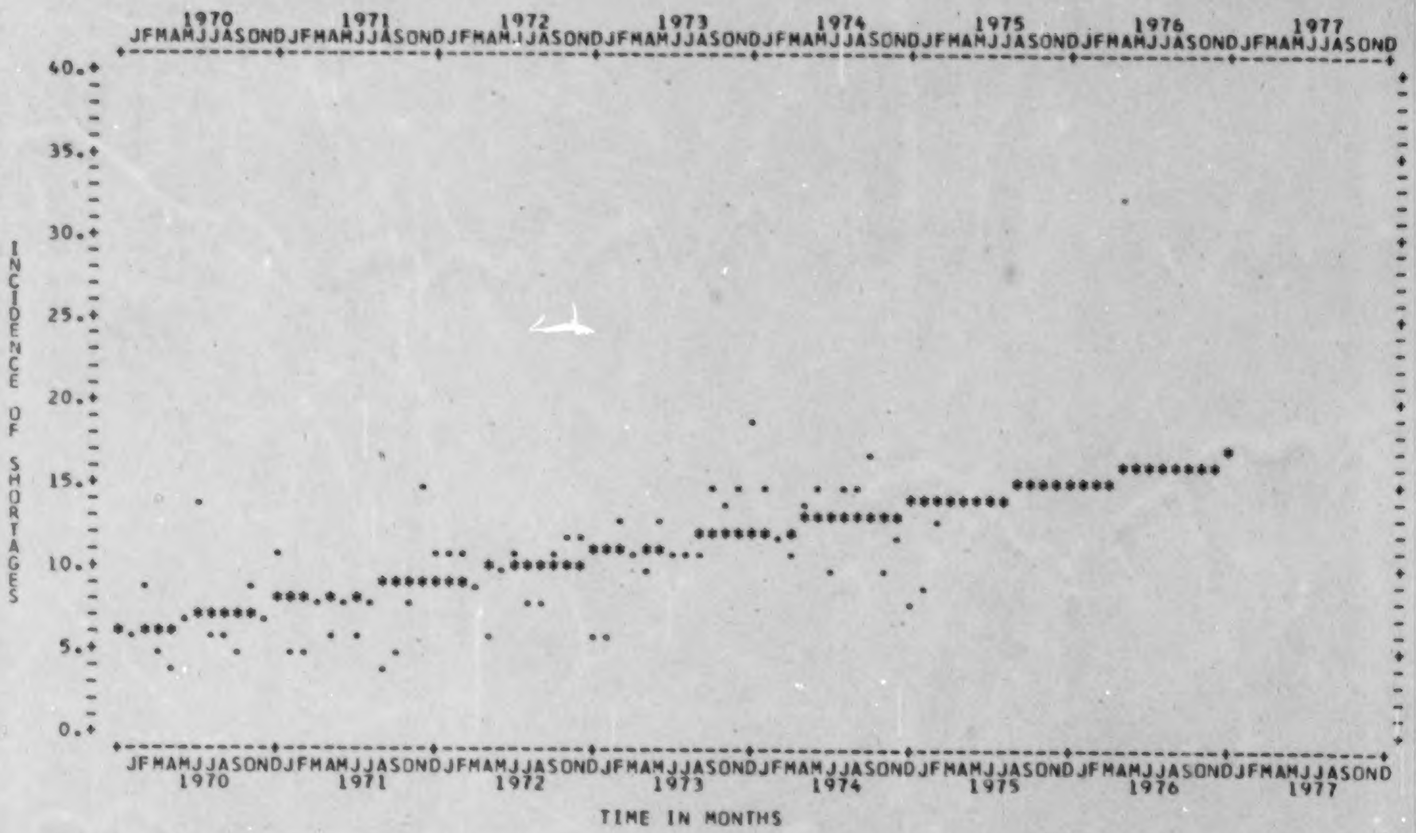
```
. = HISTORY OF DATA
* = CALCULATED DATA
```

```
AUTOMATIC MERCHANDISING (CLASSIFIED WANT-ADS DATA)                        07/07/75
```



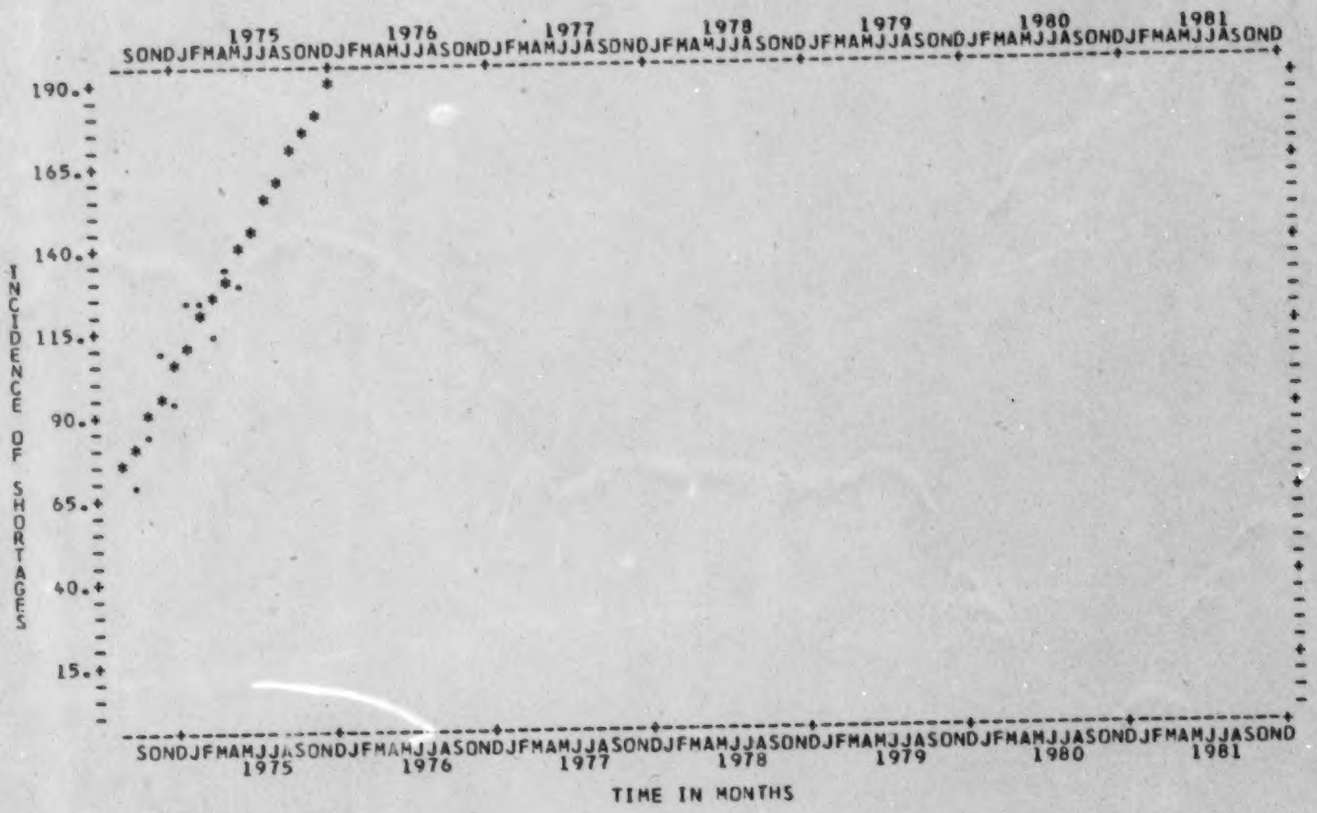
```
LEAST SQUARES TREND LINE      Y      =   5.7667 * (X) + 60.8333          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.8619                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y:X)=    8.8
STANDARD DEVIATION OF Y       S(Y)   =   17.3
COVARIANCE OF X AND Y         S(XY)  =   38.4
```

```
AUTOMOTIVE PARTS SPECIALIST (TEC DATA)                    06/09/75
```



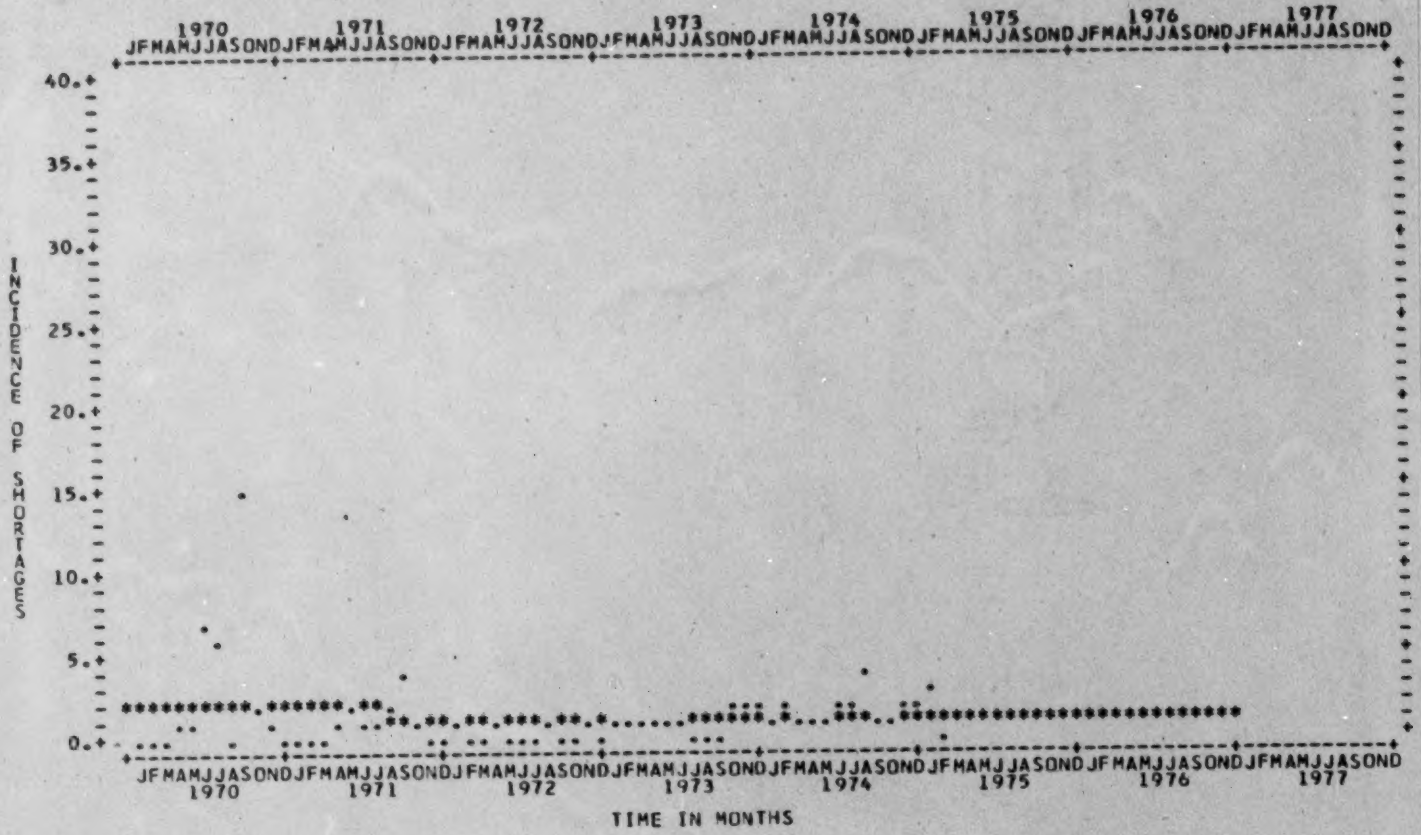
```
LEAST SQUARES T END LINE        Y      =    0.1264 * (X) +   5.9857            . = HISTORY OF DATA
COEFFICIENT OF CORRELATION      R      =    0.6370                            * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE      S(Y.X)=     2.7
STANDARD DEVIATION OF Y         S(Y)   =    3.6
COVARIANCE OF X AND Y           S(XY)  =   40.5
```

AUTOMOTIVE PARTS SPECIALIST (CLASSIFIED WANT ADS-DATA) 07/07/75



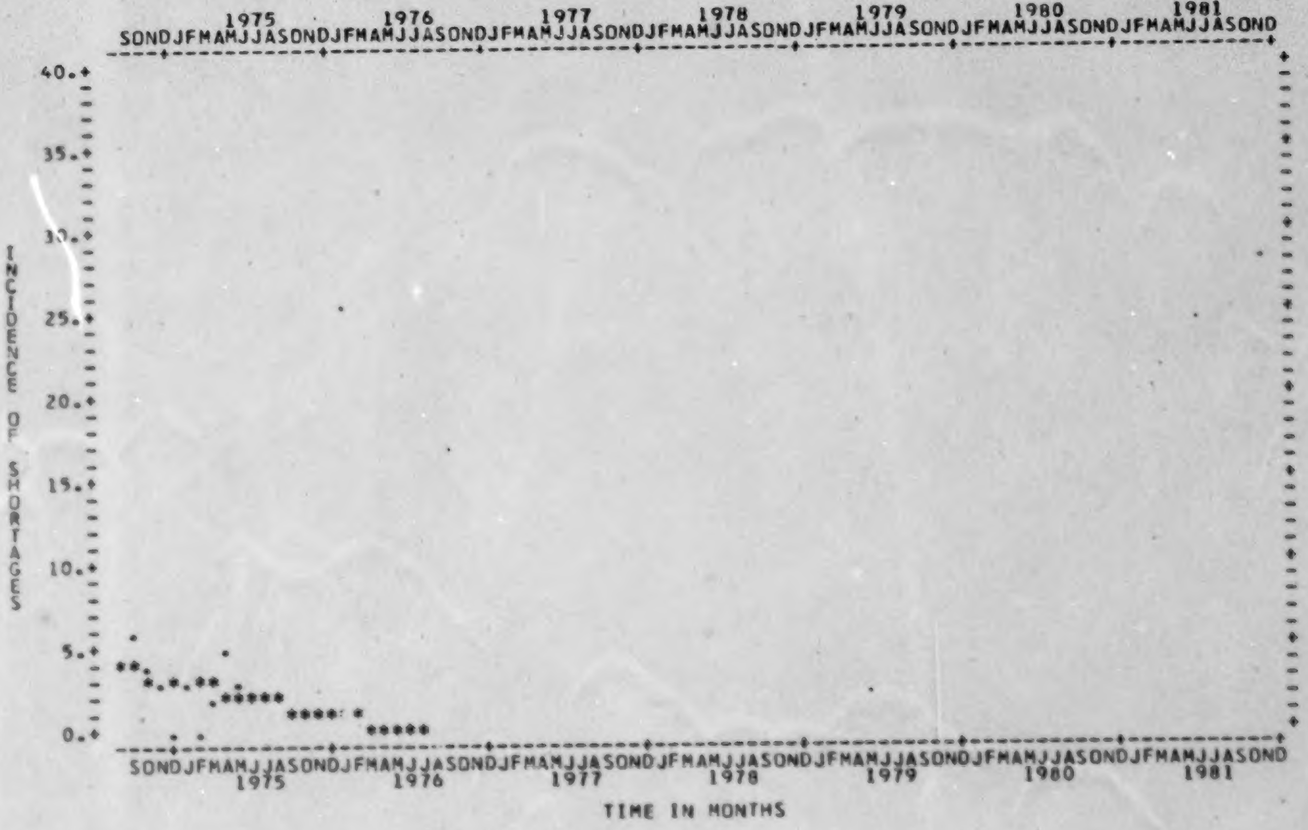
```
LEAST SQUARES TREND LINE       Y       =   7.1000 * (X) + 75.2778        . = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R       =   0.8941                        * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=     9.2
STANDARD DEVIATION OF Y        S(Y)   =   20.5
COVARIANCE OF X AND Y          S(XY)  =   47.3
```

AVIATION MAINTENANCE/AIRCRAFT PILOT TRAINING TECHNOLOGY (TEC DATA)   06/05/75



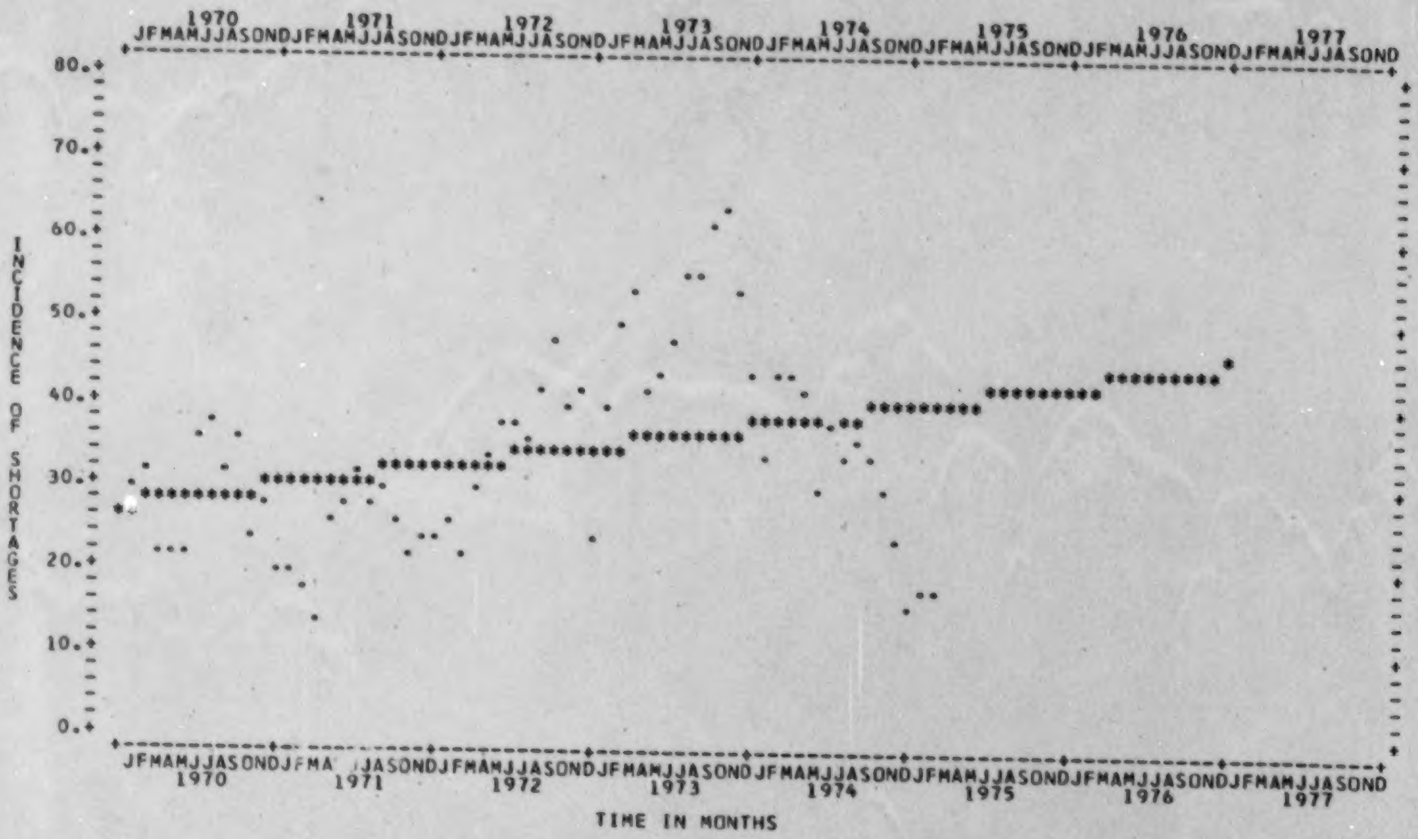
```
LEAST SQUARES T  ND LINE      Y       =  -0.0117 * (X) +  1.7229      .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R       =  -0.0944                      *  = CALCULATED DATA
STANDARD ER OR OF  STIMATE    S(Y.X)=     2.2
STANDARD DEVIATION OF Y       S(Y)   =    2.2
COVARIANCE OF X AND Y         S(XY)  =   -3.7
```

AVIATION MAINTENANCE/AIRCRAFT PILOT TRAINING (CLASSIFIED WANT-ADS DATA) 07/07/75



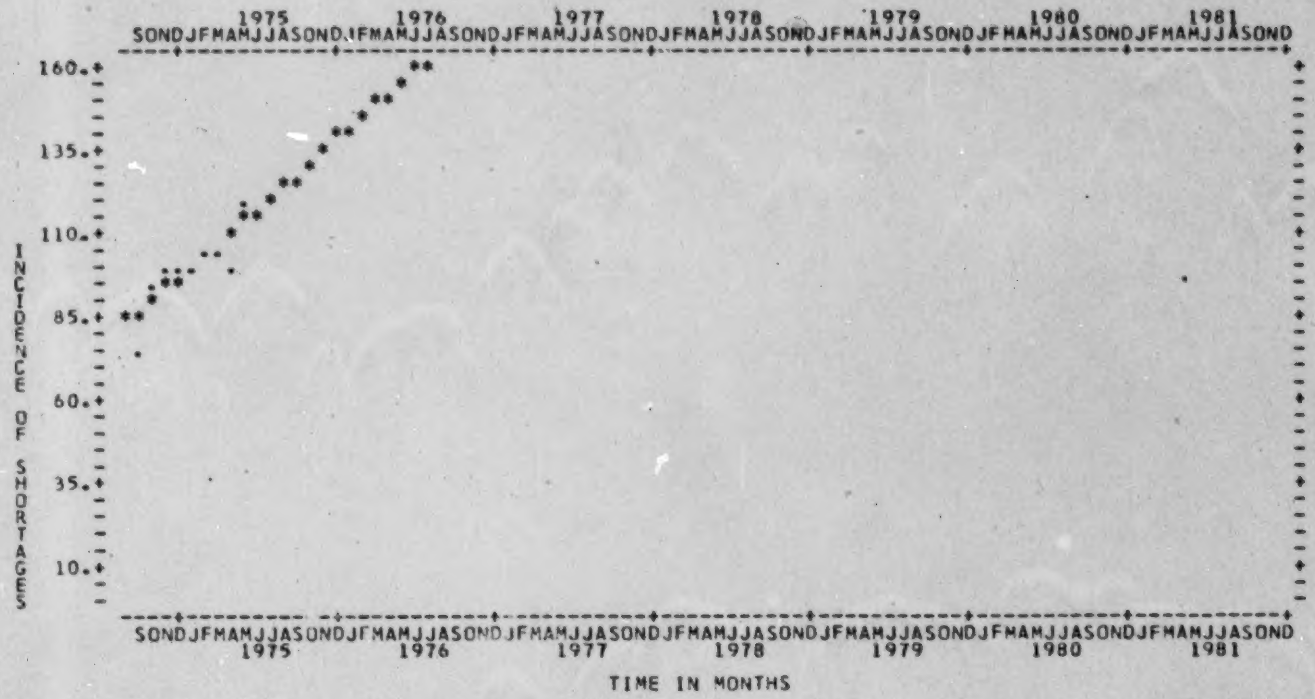
```
LEAST SQUARES TREND LINE      Y      =  -0.1833 * (X) +  3.8056          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =  -0.2476                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    1.9
STANDARD DEVIATION OF Y       S(Y)   =   1.9
COVARIANCE OF X AND Y         S(XY)_ =  -1.2
```

```
BUILDING CONSTRUCTION TECHNOLOGY (TEC DATA)          06/04/75
```



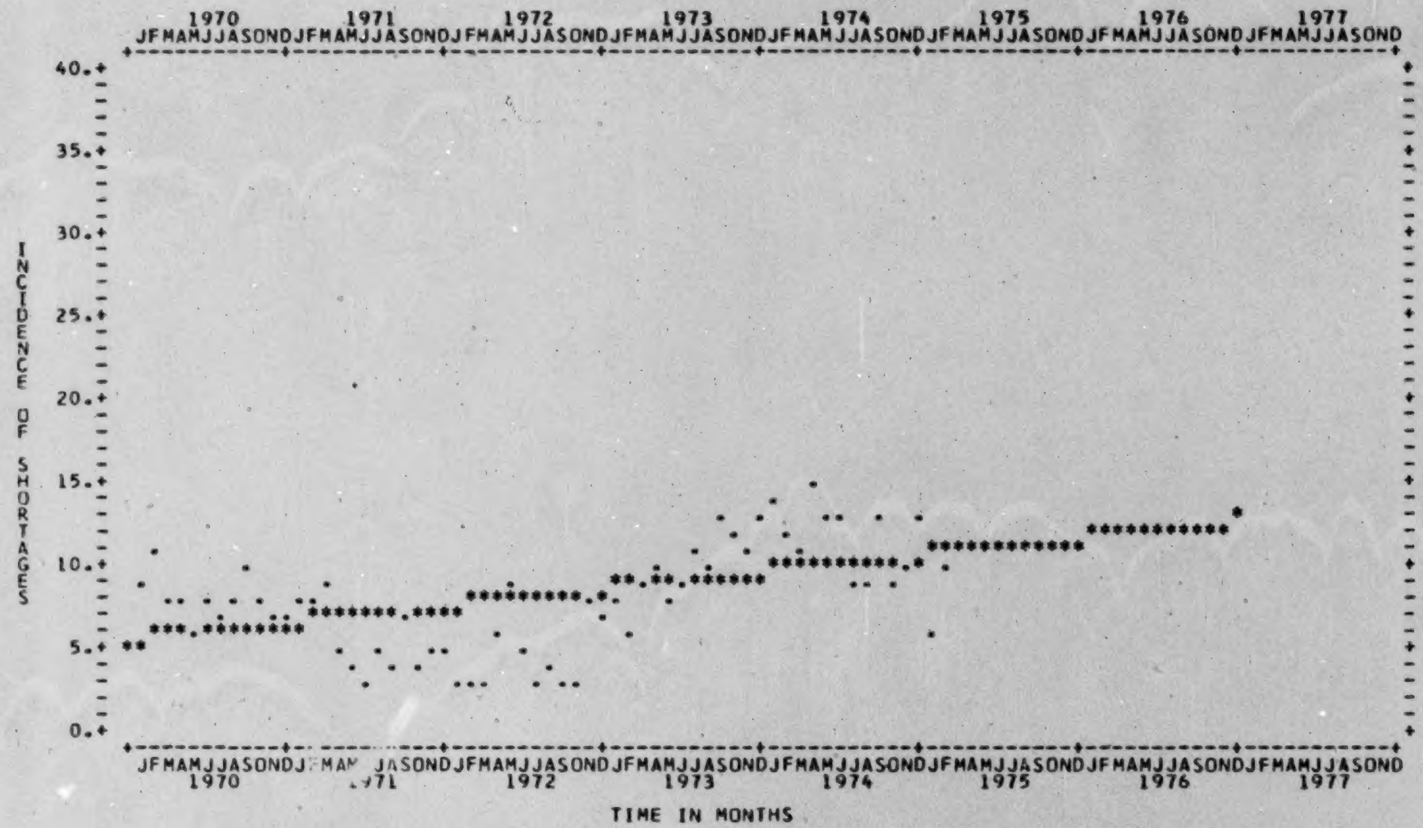
```
LEAST SQUARES TREND LINE      Y      =   0.2212 * (X) + 26.5806
COEFFICIENT OF CORRELATION    R      =   0.3402                        . = HISTORY OF DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=  10.9                            * = CALCULATED DATA
STANDARD DEVIATION OF Y       S(Y)   =  11.6
COVARIANCE OF X AND Y         S(XY)  =  70.8
```

```
BUILDING CONSTRUCTION TECHNOLOGY (CLASSIFIED WANT-ADS DATA)          07/08/75
```



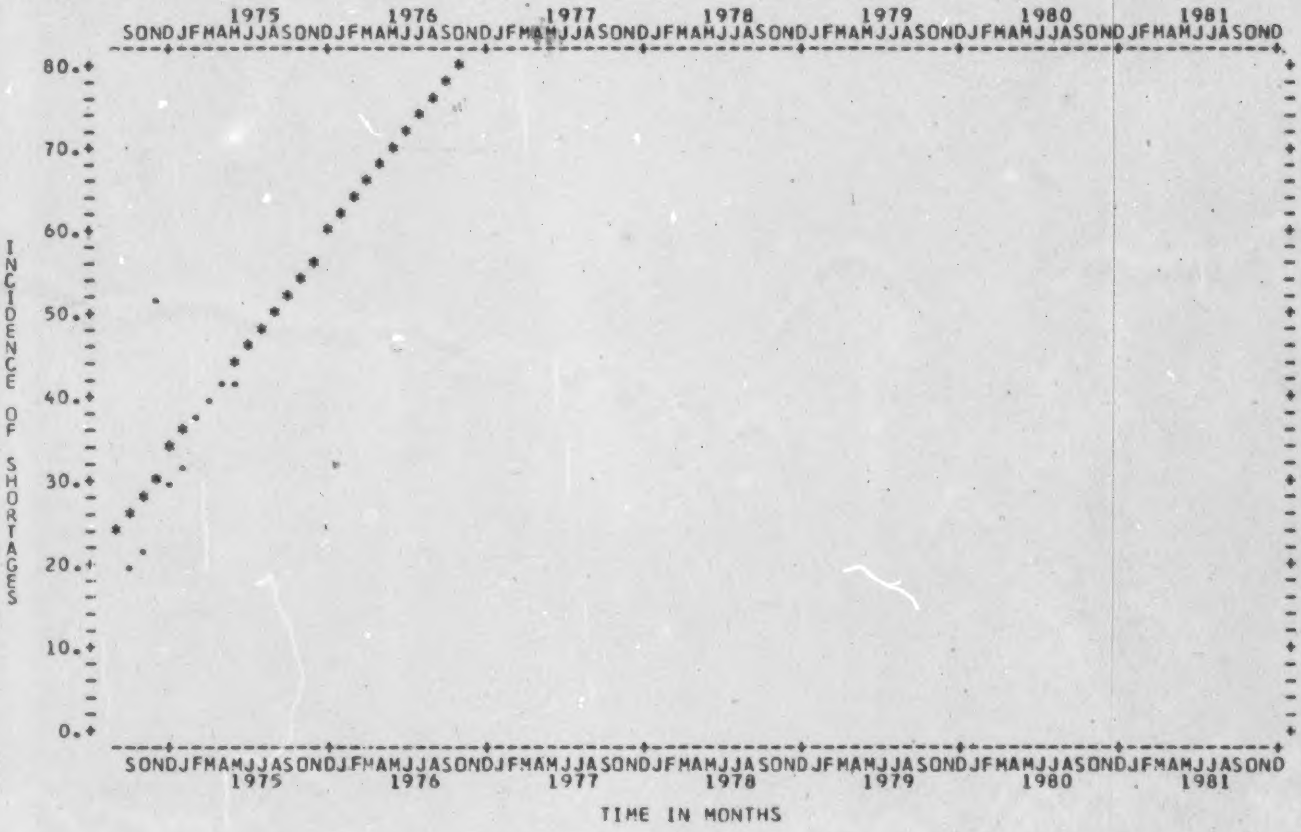
```
LEAST SQUARES TREND LINE      Y       =   3.4333 * (X) + 82.6111            .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R       =   0.7783                            *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=     7.2
STANDARD DEVIATION OF Y       S(Y)   =   11.4
COVARIANCE OF X AND Y         S(XY)  =   22.9
```

CHEMICAL TECHNOLOGY CLUSTER (TEC DATA) 06/02/75



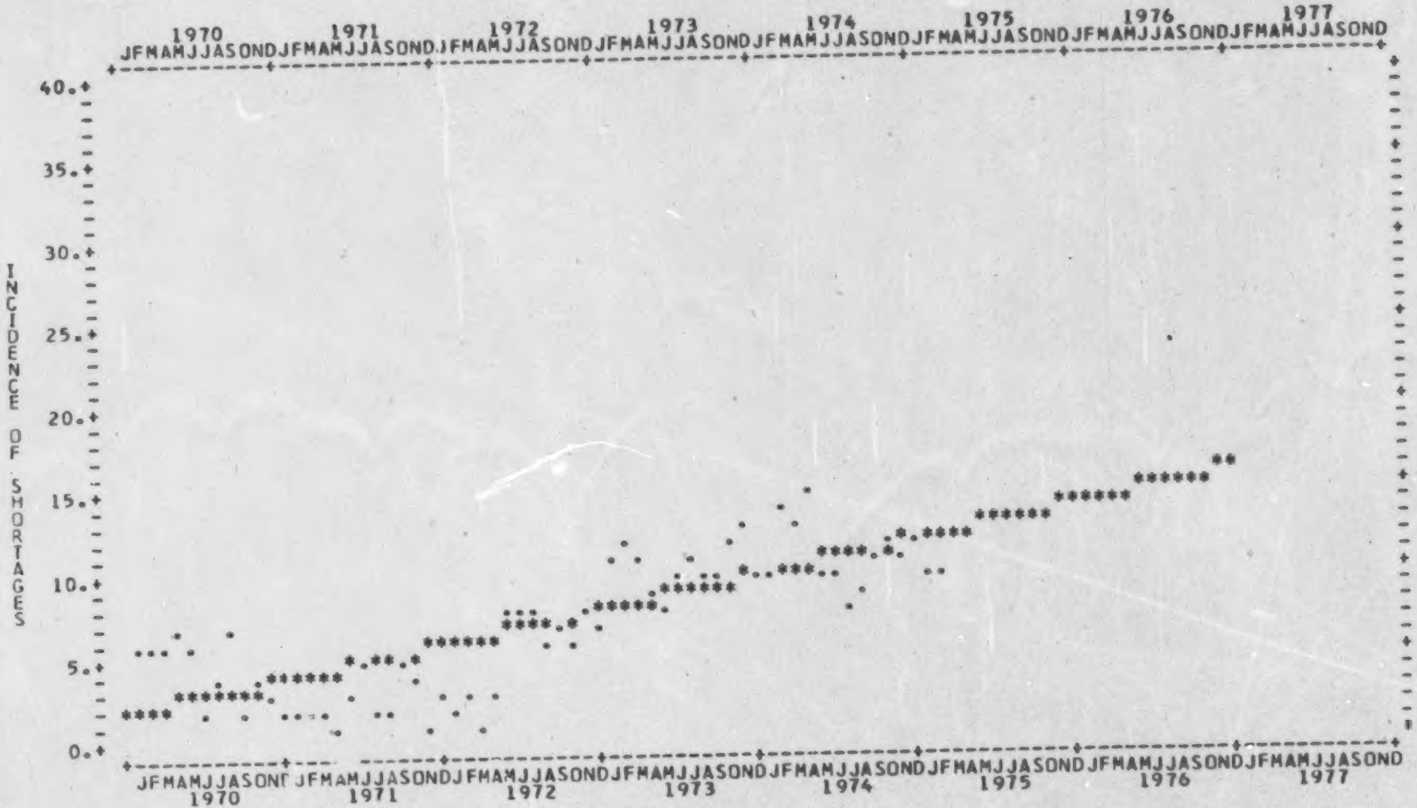
```
LEAST SQUARES TREND LINE      Y       =   0.0854 * (X) +  5.3432       .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R       =   0.4770                       *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=     2.8
STANDARD DEVIATION OF Y       S(Y)    =   3.2
COVARIANCE OF X AND Y         S(XY) =    27.3
```

```
CHEMICAL TECHNOLOGY CLUSTER (CLASSIFIED WANT-ADS DATA)                07/08/75
```



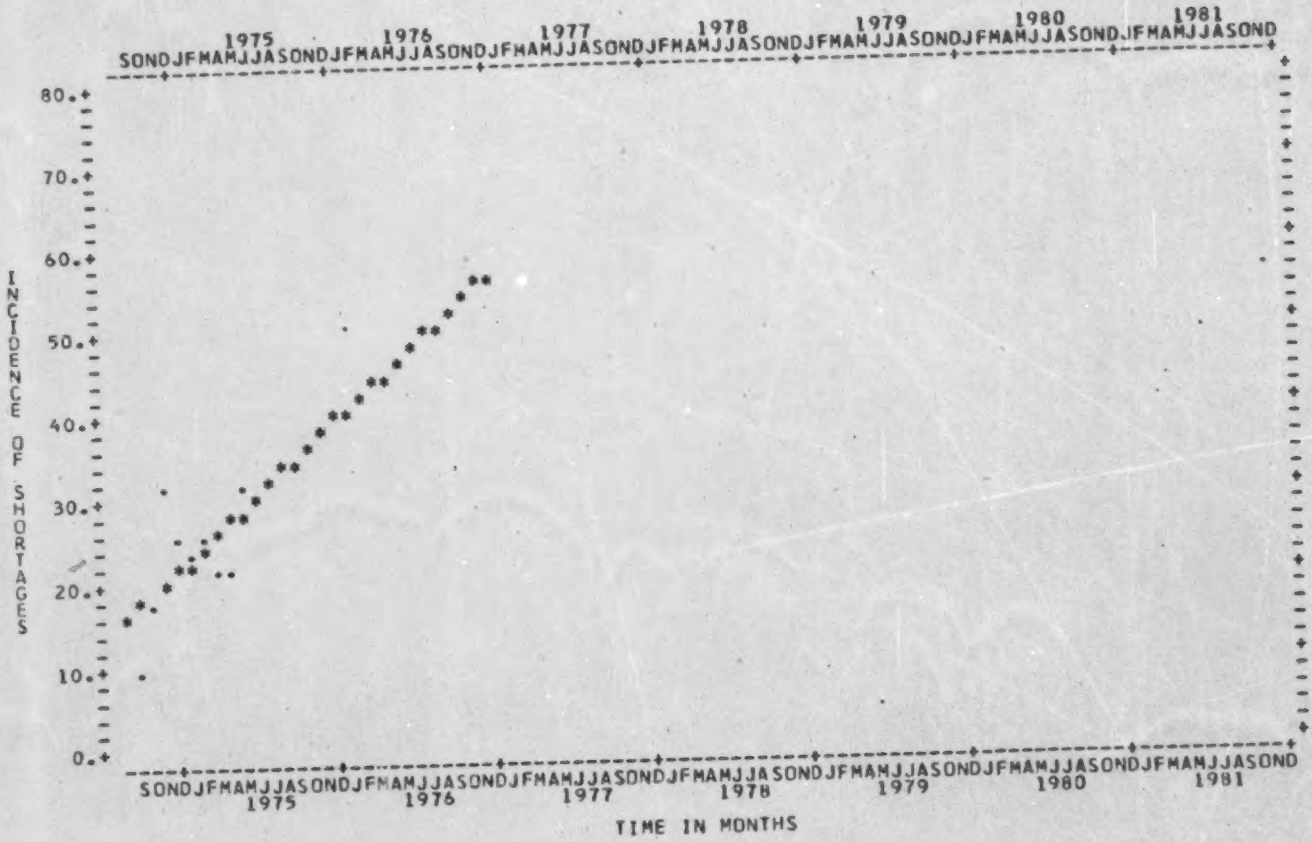
```
LEAST SQUARES TREND LINE       Y      =    2.1667 * (X) + 24.3889          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R      =    0.5792                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=     7.9
STANDARD DEVIATION OF Y        S(Y)  =     9.7
COVARIANCE OF X AND Y          S(XY)_=   14.4
```

CIVIL ENGINEERING TECHNOLOGY (TEC DATA)   06/12/75



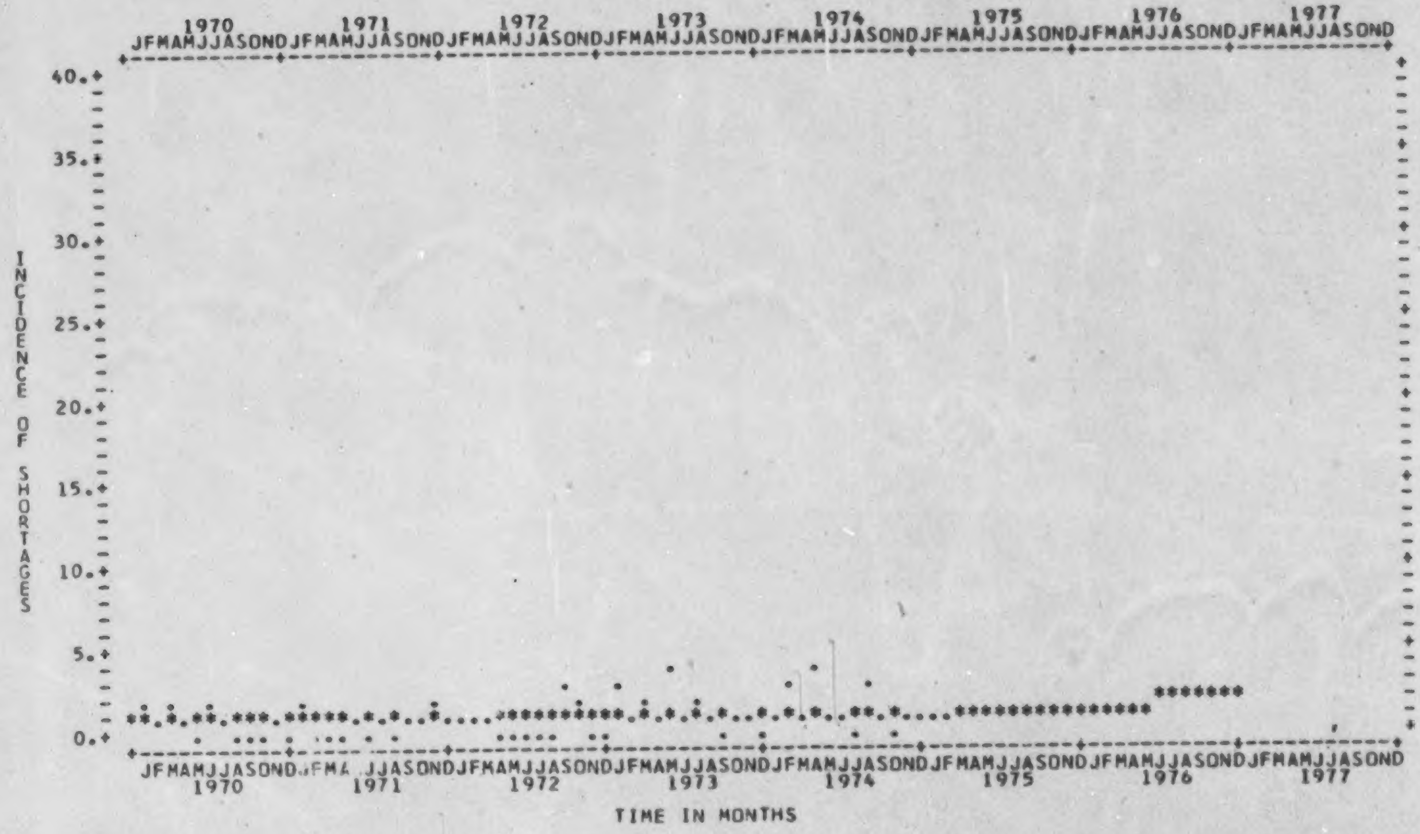
```
LEAST SQUARES TREND LINE      Y      =   0.1647 * (X) +  1.8429          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.7679                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    2.5
STANDARD DEVIATION OF Y       S(Y)   =   3.8
COVARIANCE OF X AND Y         S(XY)  =  52.8
```

```
CIVIL ENGINEERING TECHNOLOGY (CLASSIFIED WANT-ADS DATA)                    07/08/75
```



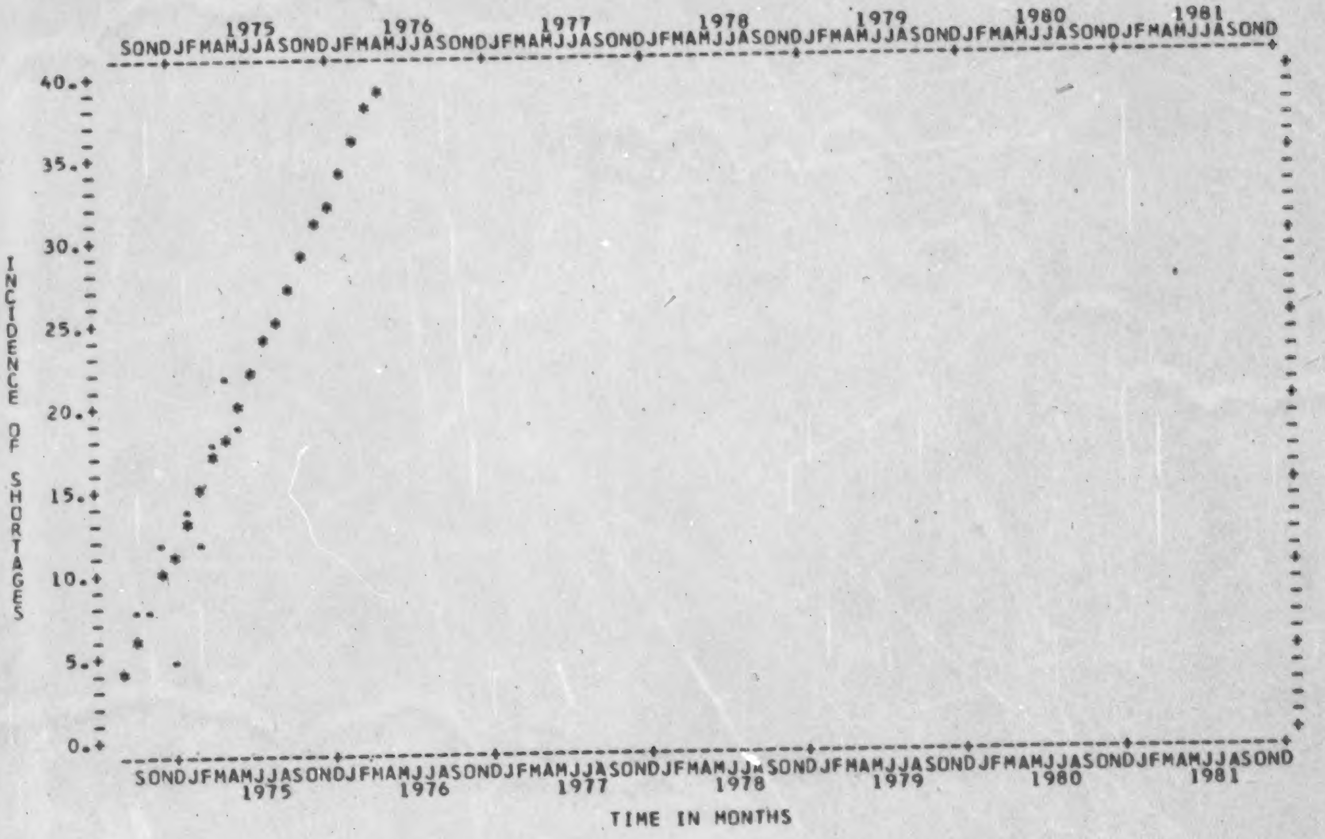
```
LEAST SQUARES TREND LINE      Y      =   1.4667 * (X) + 15.6667        : = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.5738                        * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    5.4
STANDARD DEVIATION OF Y       S(Y)   =   6.6
COVARIANCE OF X AND Y         S(XY)_ =   9.8
```

COMMERICAL ART & ADVERTISING (TEC DATA)   05/04/75



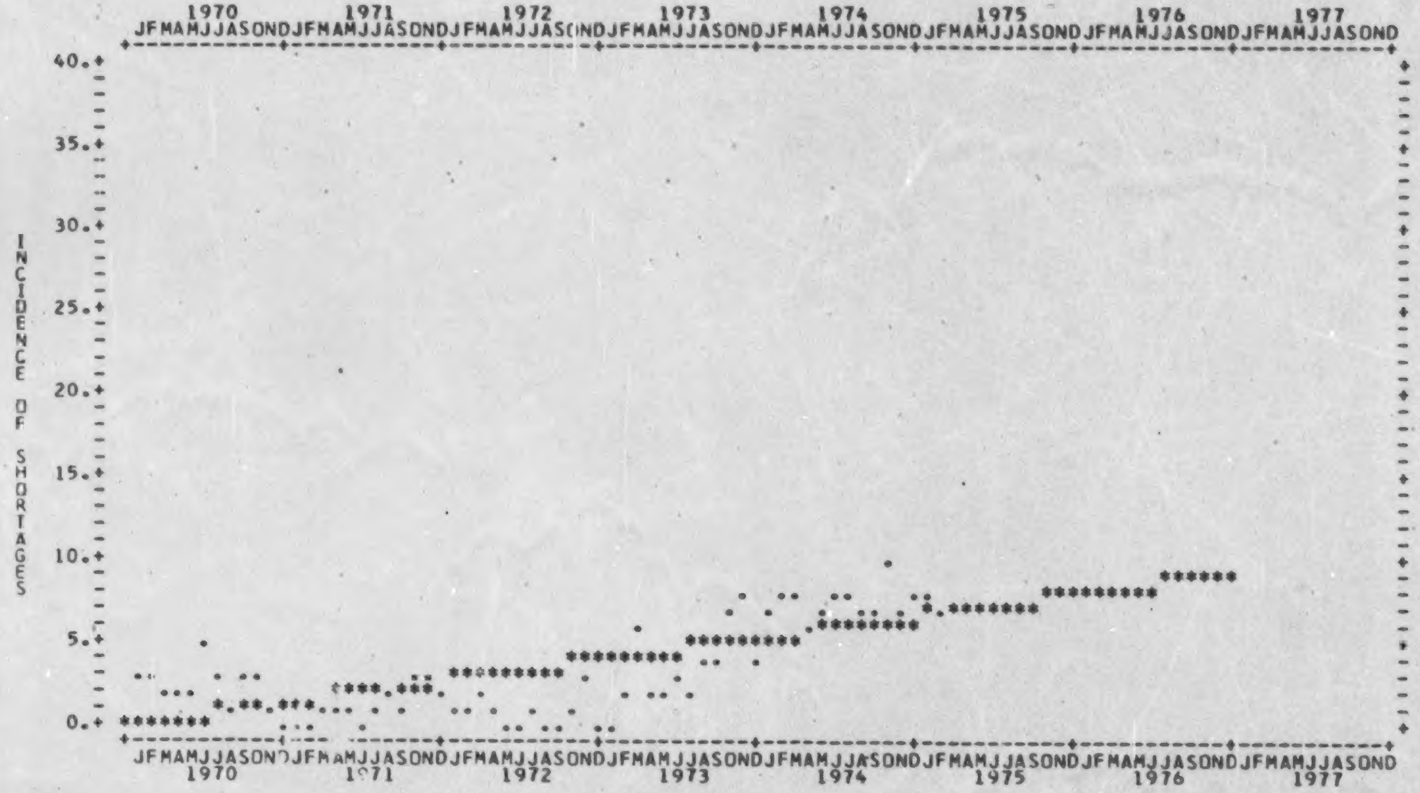
```
LEAST SQUARES TREND LINE      Y       =   0.0105 * (X) +  0.6869        .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R       =   0.1856                        *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=     1.0
STANDARD DEVIATION OF Y       S(Y)    =   1.0
COVARIANCE OF X AND Y         S(XY)   =   3.3
```

COMMERICAL ART & ADVERTISING CLUSTER (CLASSIFIED WANT-ADS DATA)   07/08/75



```
LEAST SQUARES TREND LINE      Y       =   1.7500 * (X) + 4.3611          : = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R       =   0.8425                         * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=     2.9
STANDARD DEVIATION OF Y       S(Y)    =   5.4
COVARIANCE OF X AND Y         S(XY)_ =   11.7
```

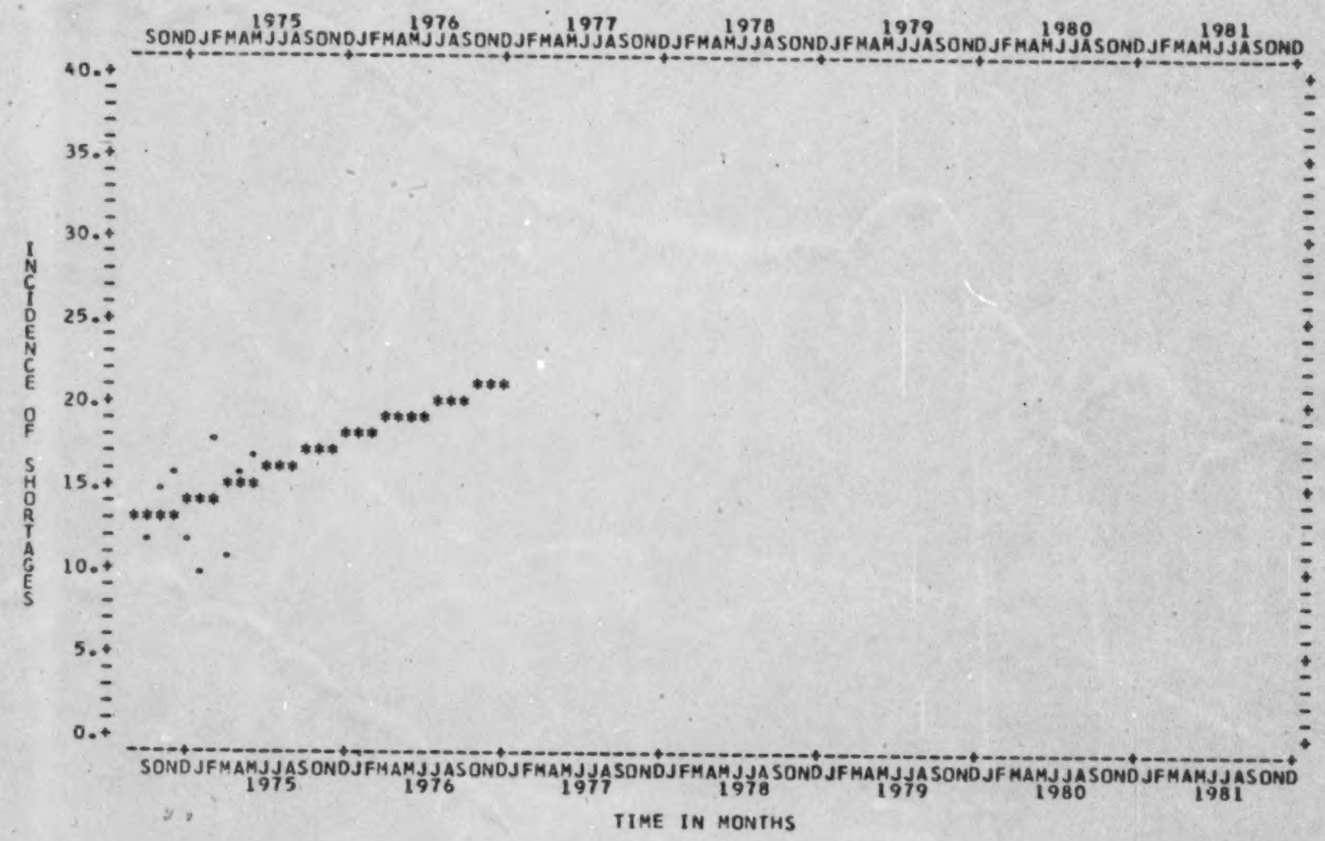
COMPUTER SCIENCE TECHNOLOGY CLUSTER (TEC DATA)   6/10/75



TIME IN MONTHS

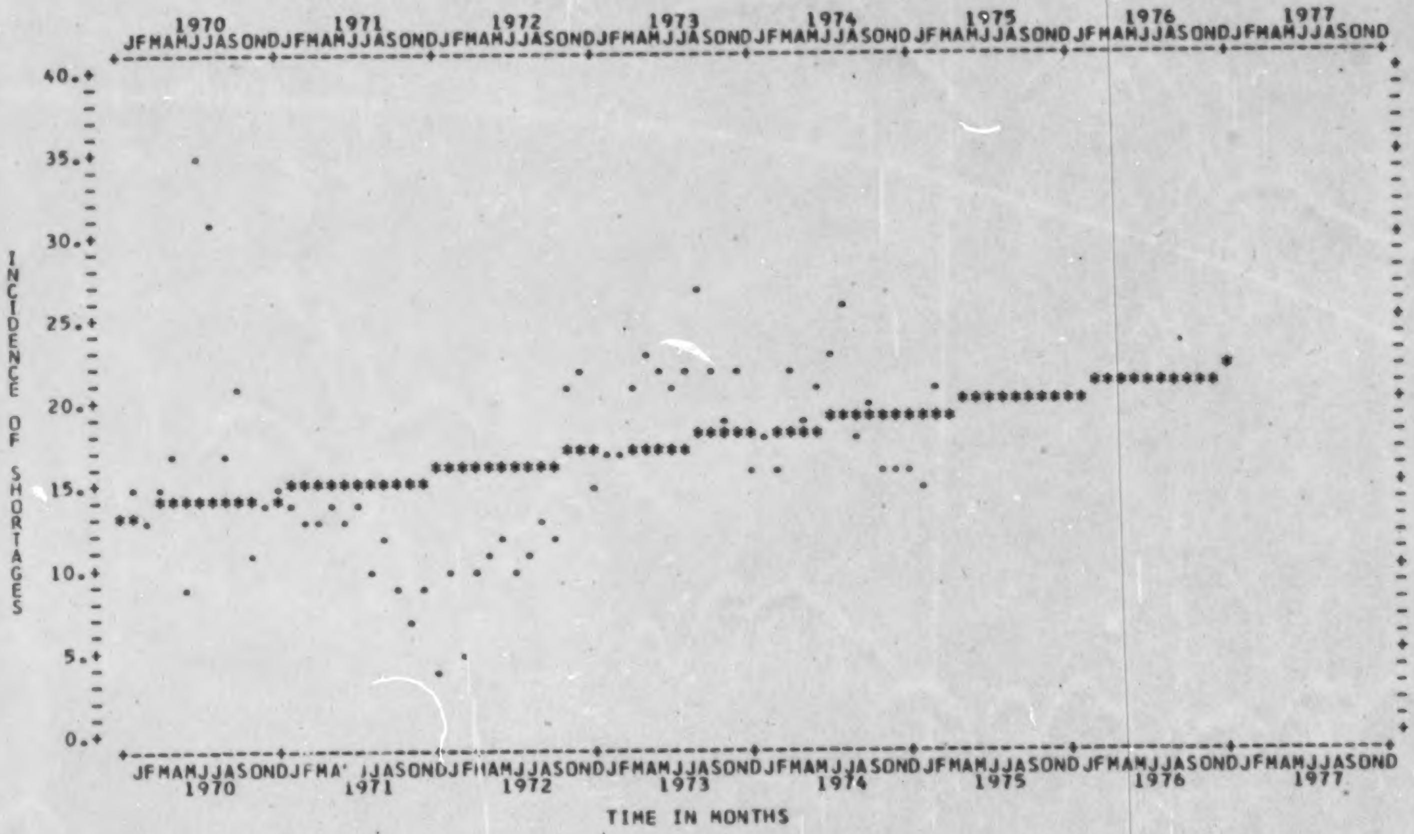
```
LEAST SQUARES TREND LINE      Y      =    0.1109 * (X) + -0.2184          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =    0.6957                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=     2.0
STANDARD DEVIATION OF Y       S(Y)   =    2.9
COVARIANCE OF X AND Y         S(XY)  =   35.5
```

```
COMPUTER SCIENCE TECHNOLOGY CLUSTER (CLASSIFIED WANT-ADS DATA)        07/08/75
```



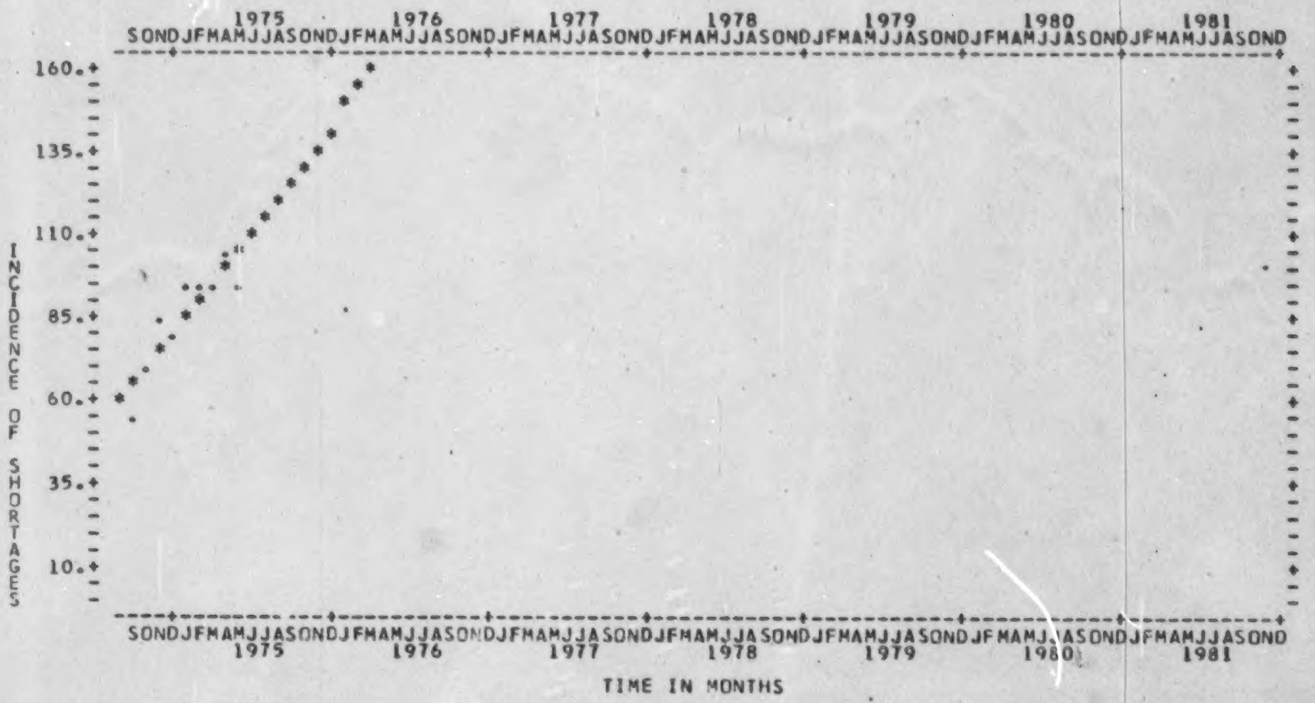
```
LEAST SQUARES TREND LINE      Y      =   0.3167 * (X) + 12.5278        .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.2999                        *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    2.6
STANDARD DEVIATION OF Y       S(Y)   =   2.7
COVARIANCE OF X AND Y         S(XY)_ =   2.1
```

DENTAL ASSISTANT PROGRAM CLUSTER (TEC DATA) 06/10/75



```
LEAST SQUARES TREND LINE     Y      =    0.0993 * (X) + 13.2094        . = HISTORY OF DATA
COEFFICIENT OF CORRELATION   R      =    0.3029                        * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE   S(Y.X)=     5.6
STANDARD DEVIATION OF Y      S(Y)   =    5.9
COVARIANCE OF X AND Y        S(XY)  =   31.8
```

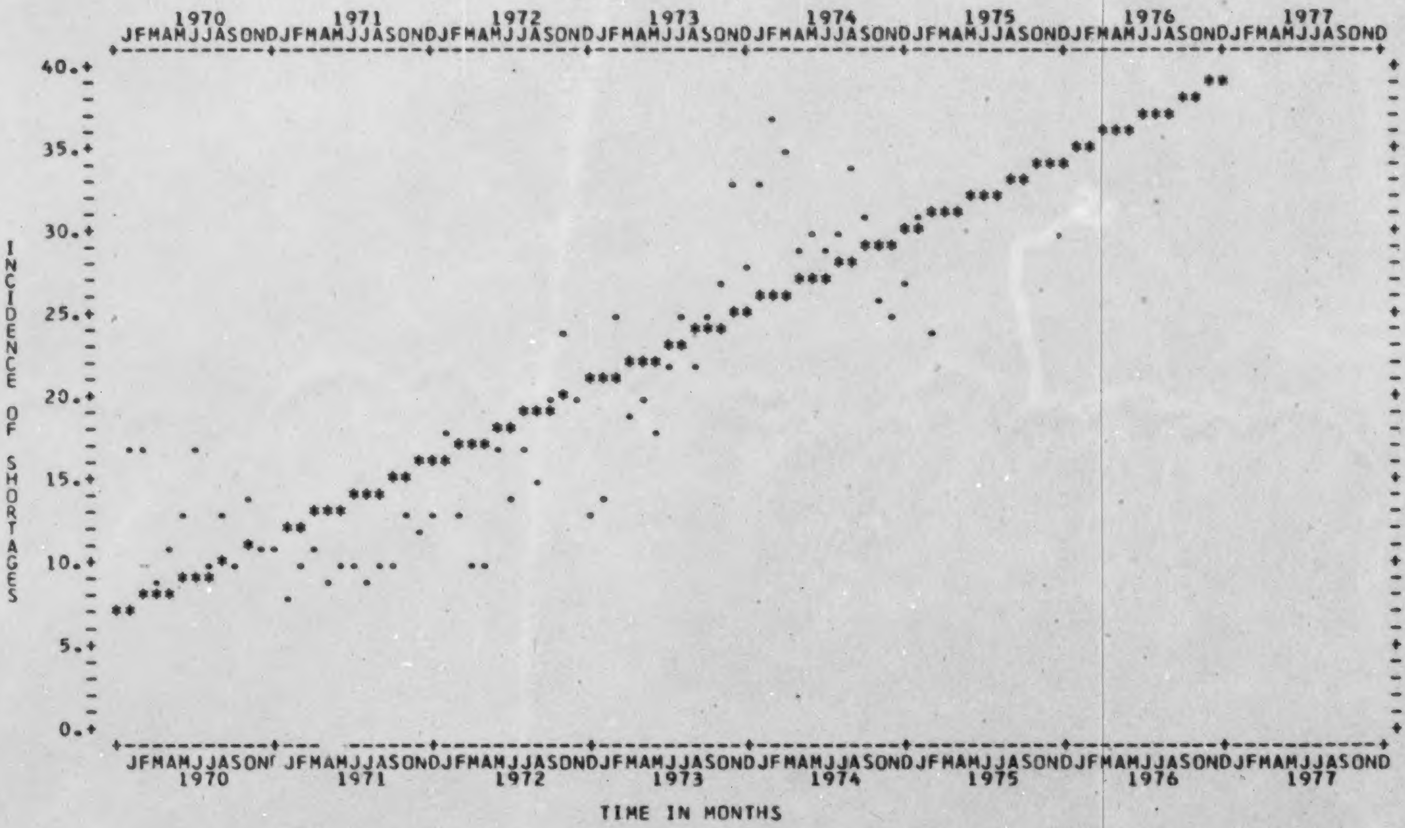
DENTAL ASSISTANT PROGRAM CLUSTER (CLASSIFIED WANT-ADS DATA) 07/09/75



```
LEAST SQUARES TREND LINE       Y      =   5.1167 * (X) + 60.5278
COEFFICIENT OF CORRELATION     R      =   0.8882
STANDARD ERROR OF ESTIMATE     S(Y.X)=    6.8
STANDARD DEVIATION OF Y        S(Y)   =   14.9
COVARIANCE OF X AND Y          S(XY)  =   34.1
```

```
. = HISTORY OF DATA
* = CALCULATED DATA
```

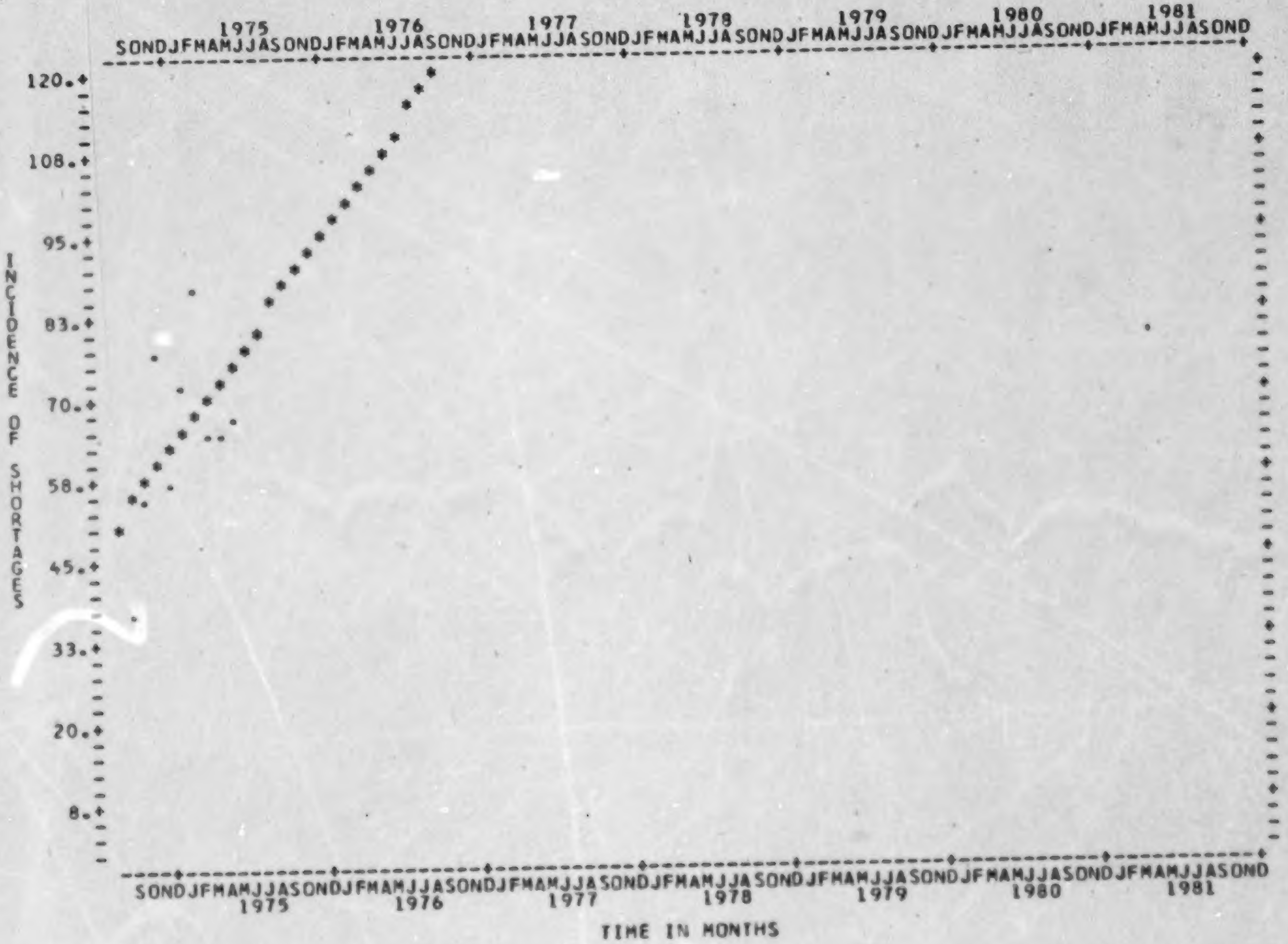
DRAFTING & DESIGN TECHNOLOGY CLUSTER (TEC DATA)   6/12/75



```
LEAST SQUARES TREND LINE       Y      =   0.3832 * (X) +  6.7673
COEFFICIENT OF CORRELATION     R      =   0.8350
STANDARD ERROR OF ESTIMATE     S(Y.X)=    4.5
STANDARD DEVIATION OF Y        S(Y)   =   8.2
COVARIANCE OF X AND Y          S(XY) =  122.7
```

. = HISTORY OF DATA
* = CALCULATED DATA

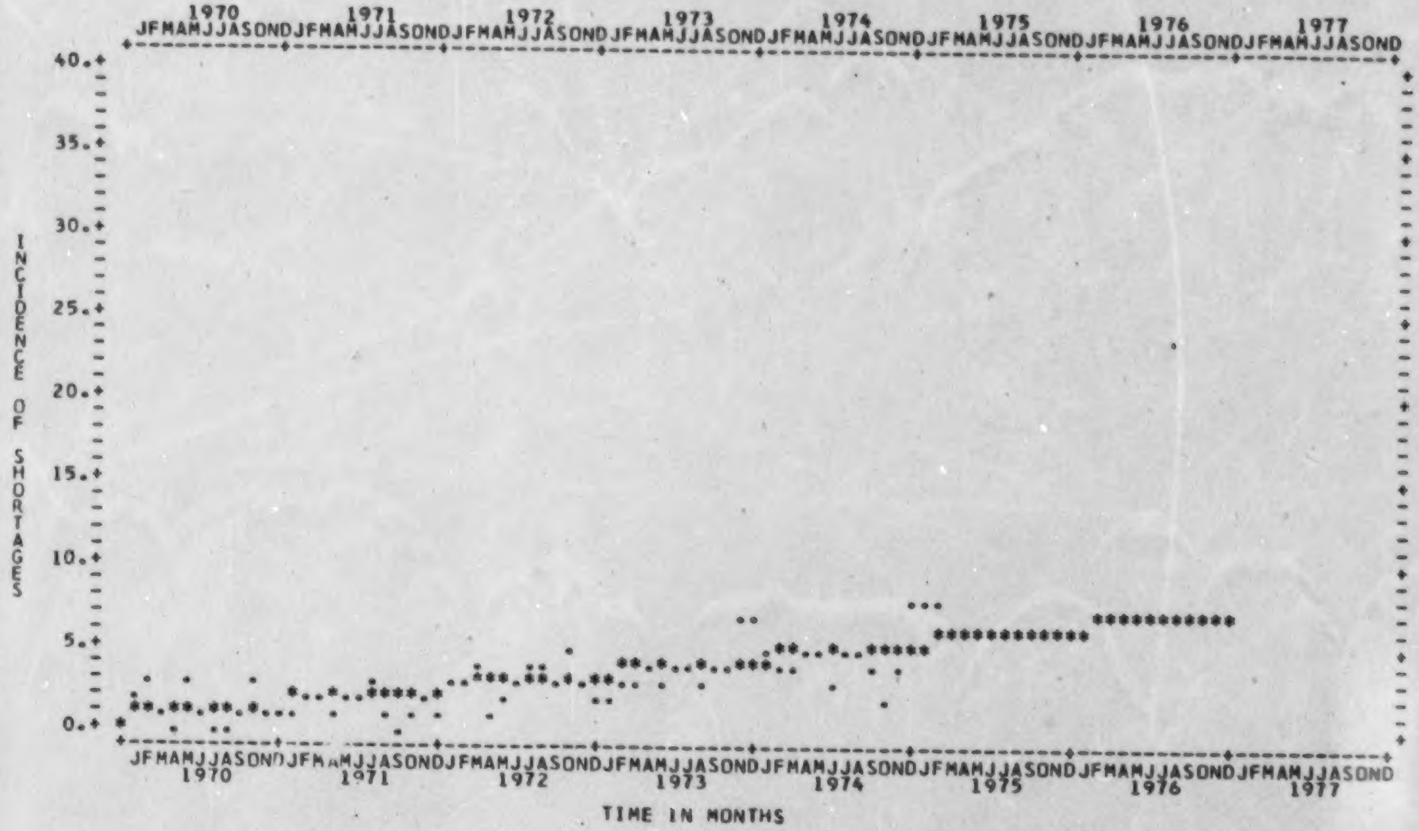
DRAFTING & DESIGN TECHNOLOGY MAJORS (CLASSIFIED WANT-ADS DATA) 07/09/75



```
LEAST SQUARES TREND LINE        Y      =   2.7333 * (X) + 51.1111
COEFFICIENT OF CORRELATION      R     -=   0.5136
STANDARD ERROR OF ESTIMATE      S(Y.X)=   11.8
STANDARD DEVIATION OF Y         S(Y)  =   13.7
COVARIANCE OF X AND Y           S(XY) =   18.2
```

: = HISTORY OF DATA
* = CALCULATED DATA

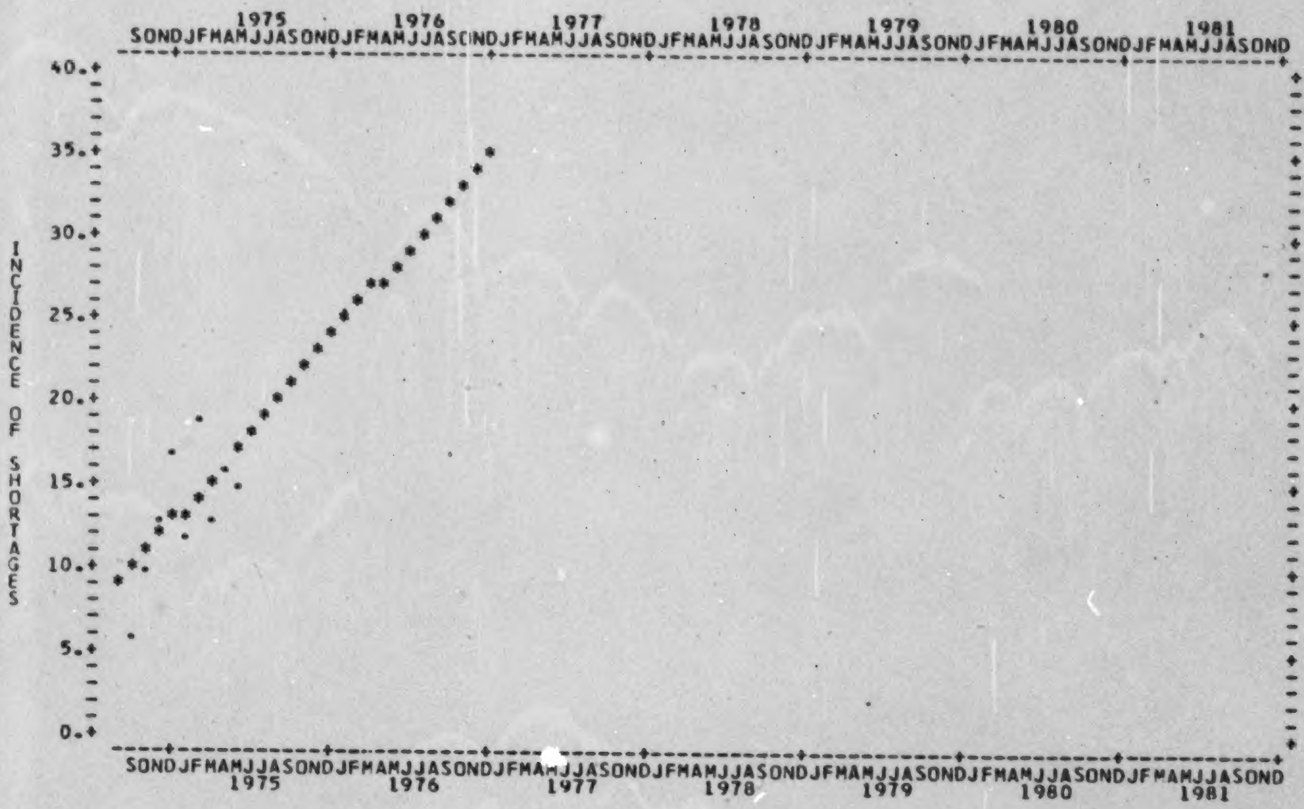
DRAFTING NOT CLASSIFIED (TEC DATA)   06/02/75



```
LEAST SQUARES TREND LINE      Y      =   0.0819 * (X) +  0.4696
COEFFICIENT OF CORRELATION    R      =   0.7560
STANDARD ERROR OF ESTIMATE    S(Y.X)=    1.3
STANDARD DEVIATION OF Y       S(Y)   =   1.9
COVARIANCE OF X AND Y         S(XY)  =  26.2
```

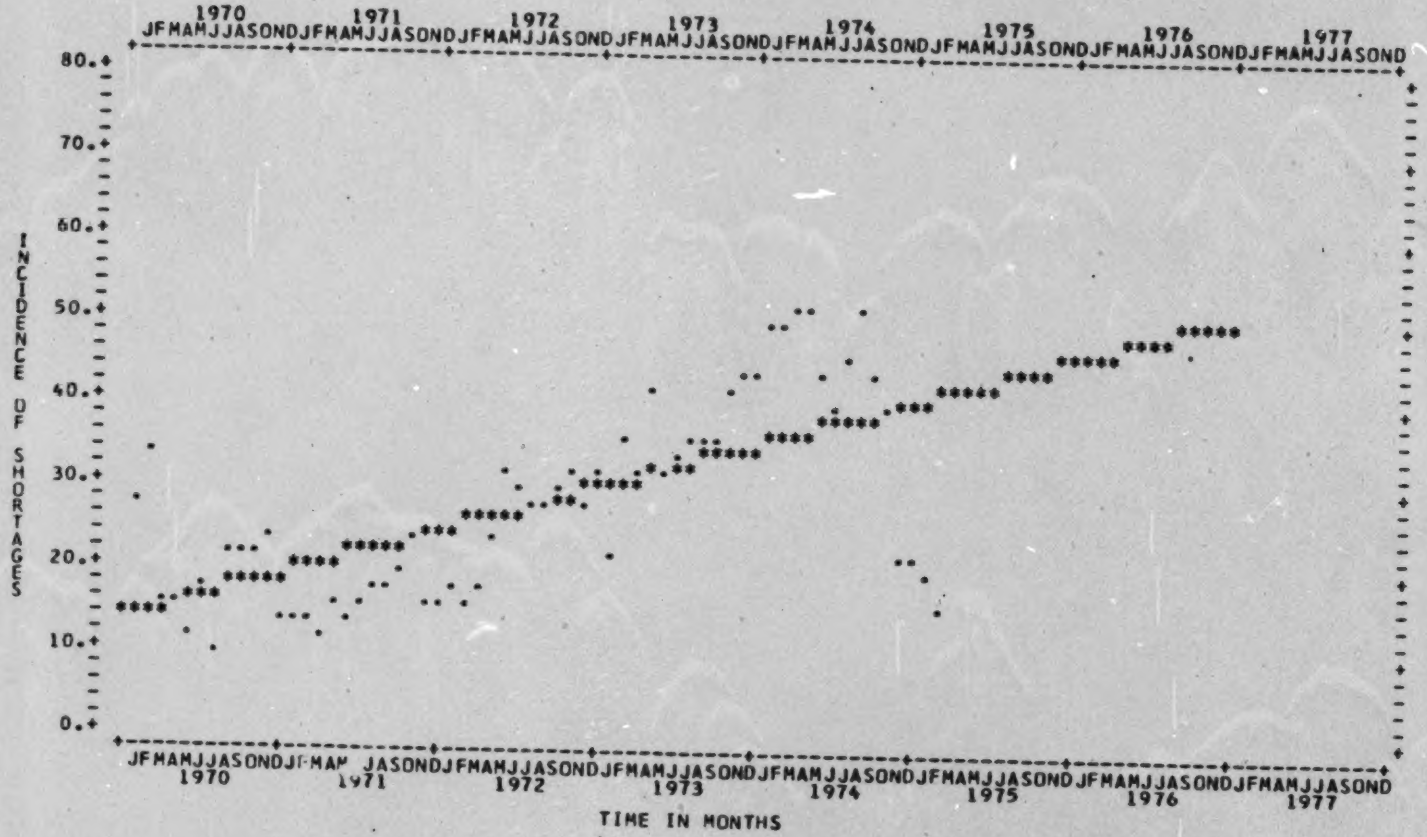
```
.  = HISTORY OF DATA
*  = CALCULATED DATA
```

```
DRAFTING **NOT CLASSIFIED** (CLASSIFIED WANT-ADS DATA)                07/09/75
```



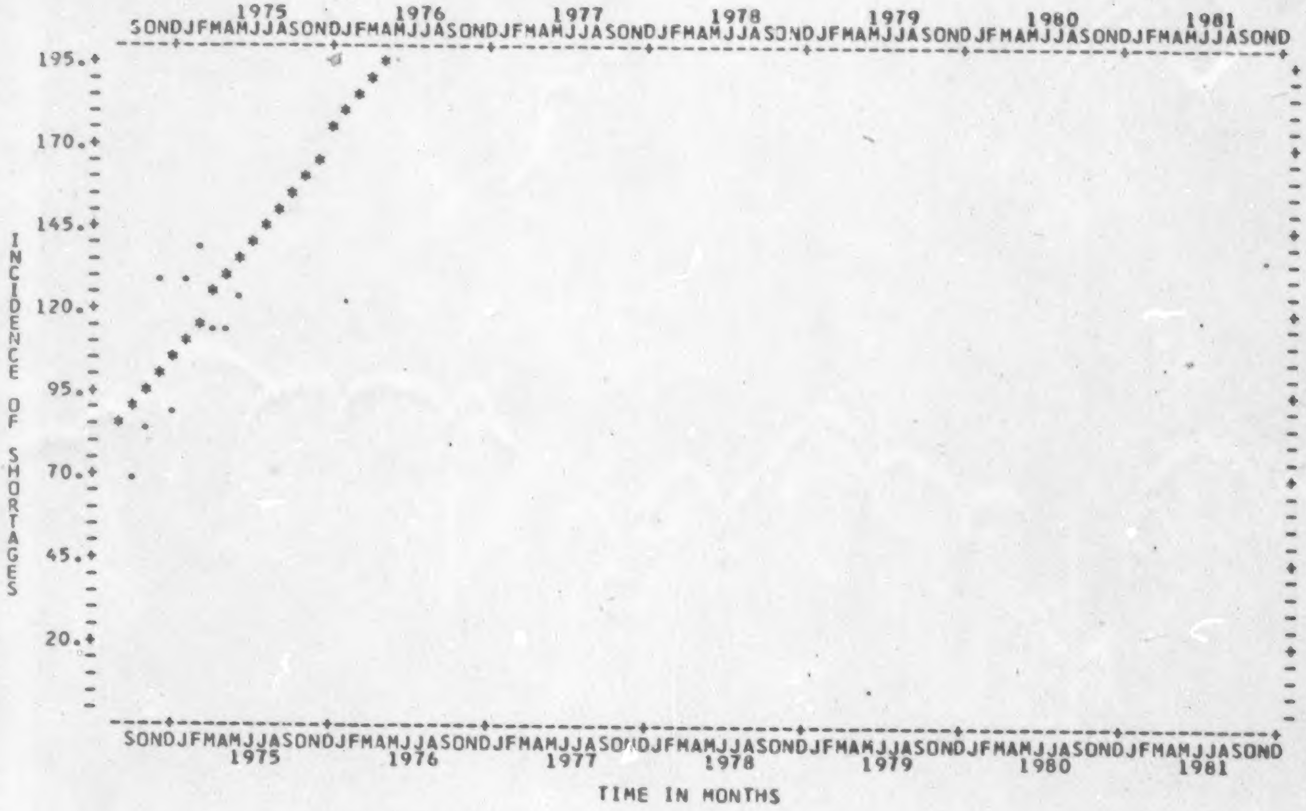
```
LEAST SQUARES TREND LINE      Y      =   0.9333 * (X) +  8.7778         .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.6539                         *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    2.8
STANDARD DEVIATION OF Y       S(Y)  =    3.7
COVARIANCE OF X AND Y         S(XY)_ =   6.2
```

ELECTRICAL POWER DISTRIBUTION CLUSTER (TEC DATA)   06/06/75



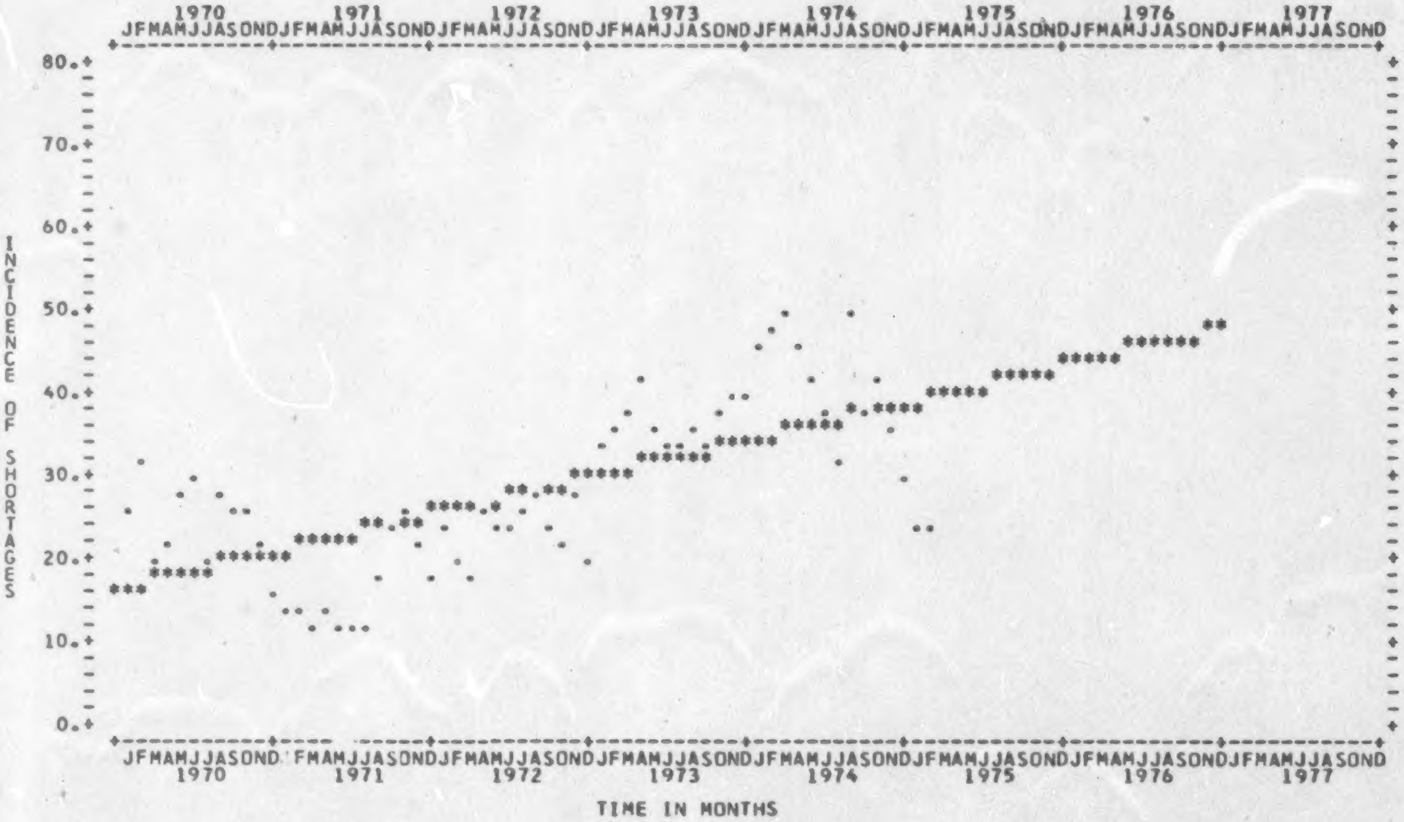
```
LEAST SQUARES TREND LINE       Y      =    0.4455 * (X) + 13.5637        . = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R      =    0.6766                        * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=     8.7
STANDARD DEVIATION OF Y        S(Y)   =   11.8
COVARIANCE OF X AND Y          S(XY)  =  142.7
```

ELECTRICAL POWER DISTRIBUTION TECHNOLOGY (CLASSIFIED WANT-ADS DATA) 07/11/75



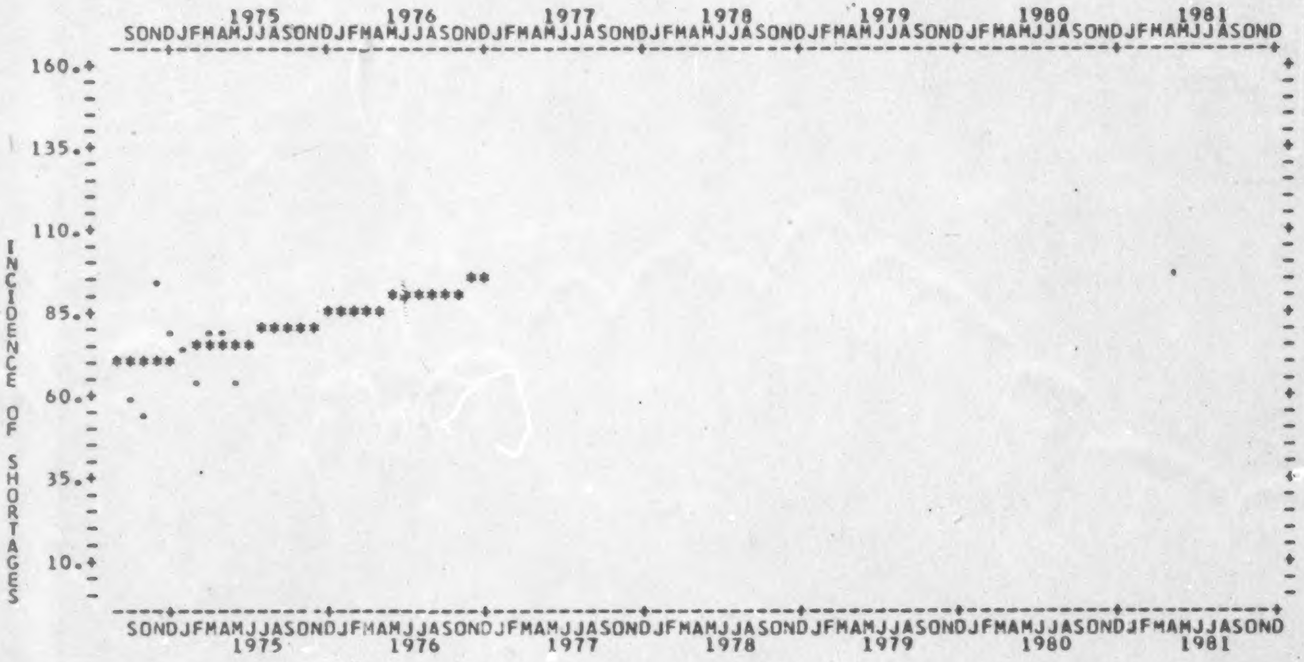
```
LEAST SQUARES TREND LINE      Y      =   5.5667 * (X) + 83.6111        . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.6215                        * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=   18.1
STANDARD DEVIATION OF Y       S(Y)  =   23.1
COVARIANCE OF X AND Y         S(XY) =   37.1
```

```
ELECTRONIC TECHNOLOGY (TEC DATA)                              6/12/75
```



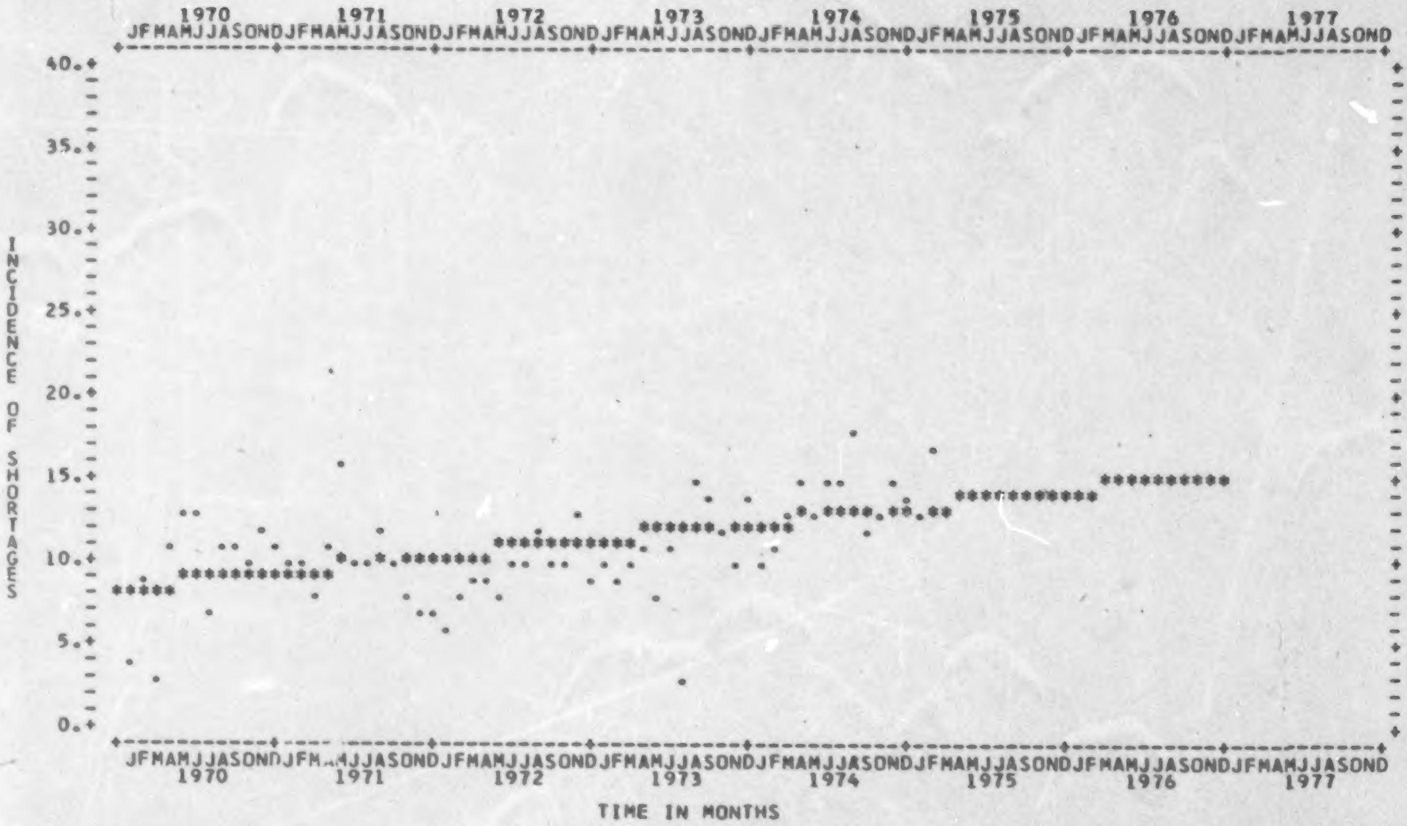
```
LEAST SQUARES TREND LINE      Y      =   0.3758 * (X) + 16.0650        . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.6643                        * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y,X)=    7.6
STANDARD DEVIATION OF Y       S(Y)   =  10.1
COVARIANCE OF X AND Y         S(XY)  = 120.4
```

ELECTRONIC TECHNOLOGY (CLASSIFIED WANT-ADS DATA)   07/11/75



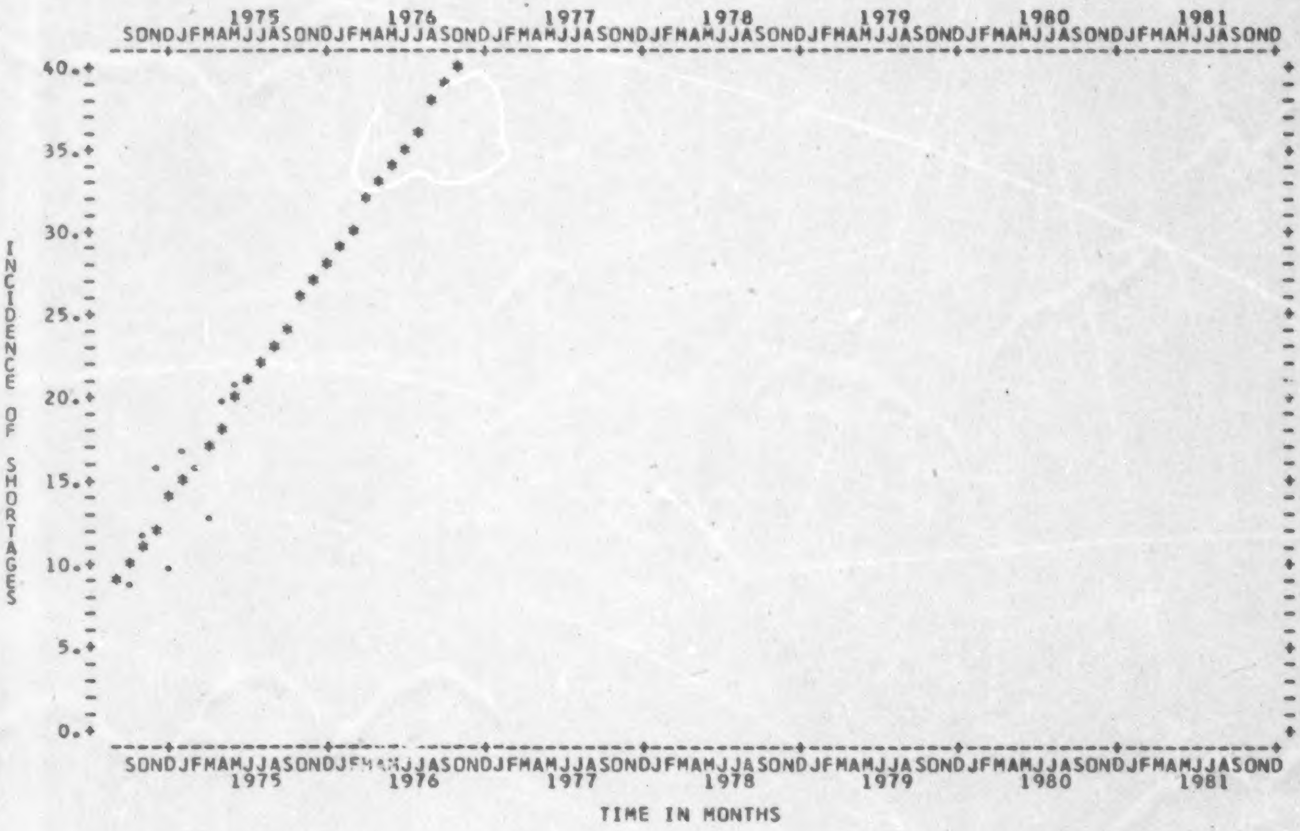
```
LEAST SQUARES TREND LINE     Y      =   0.9167 * (X) + 68.3055          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION   R      =   0.2049                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE   S(Y.X)=   11.3
STANDARD DEVIATION OF Y      S(Y)   =   11.6
COVARIANCE OF X AND Y        S(XY) =    6.1
```

FARM MACHINERY MECHANIC (TEC DATA) 6/17/75



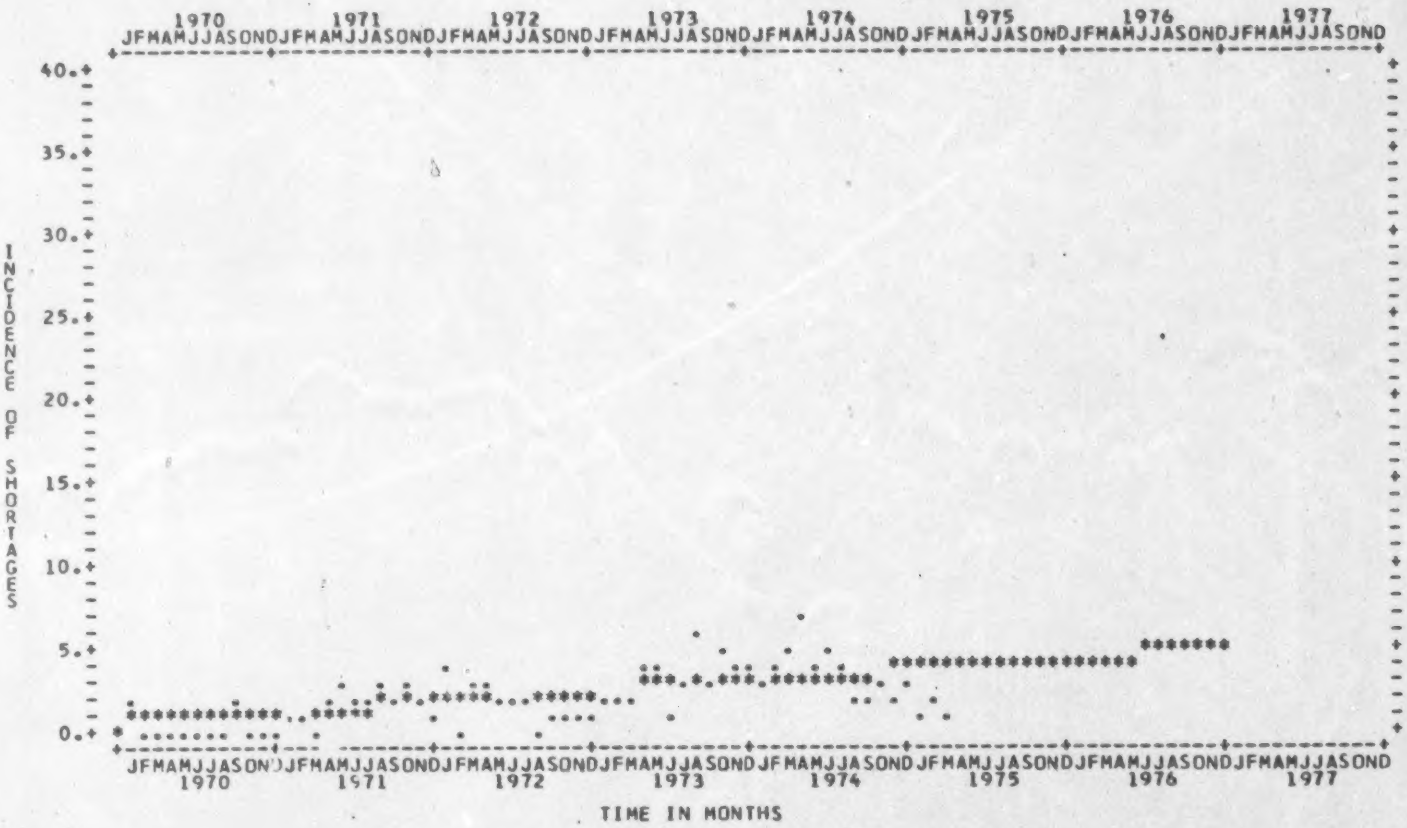
```
LEAST SQUARES TREND LINE     Y      =    0.0859 * (X) + 8.0846        . = HISTORY OF DATA
COEFFICIENT OF CORRELATION   R      =    0.5042                       * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE   S(Y.X)=     2.6
STANDARD DEVIATION OF Y      S(Y)   =    3.0
COVARIANCE OF X AND Y        S(XY)  =   27.5
```

```
FARM MACHINERY MECHANIC (CLASSIFIED WANT-ADS DATA)          07/11/75
```



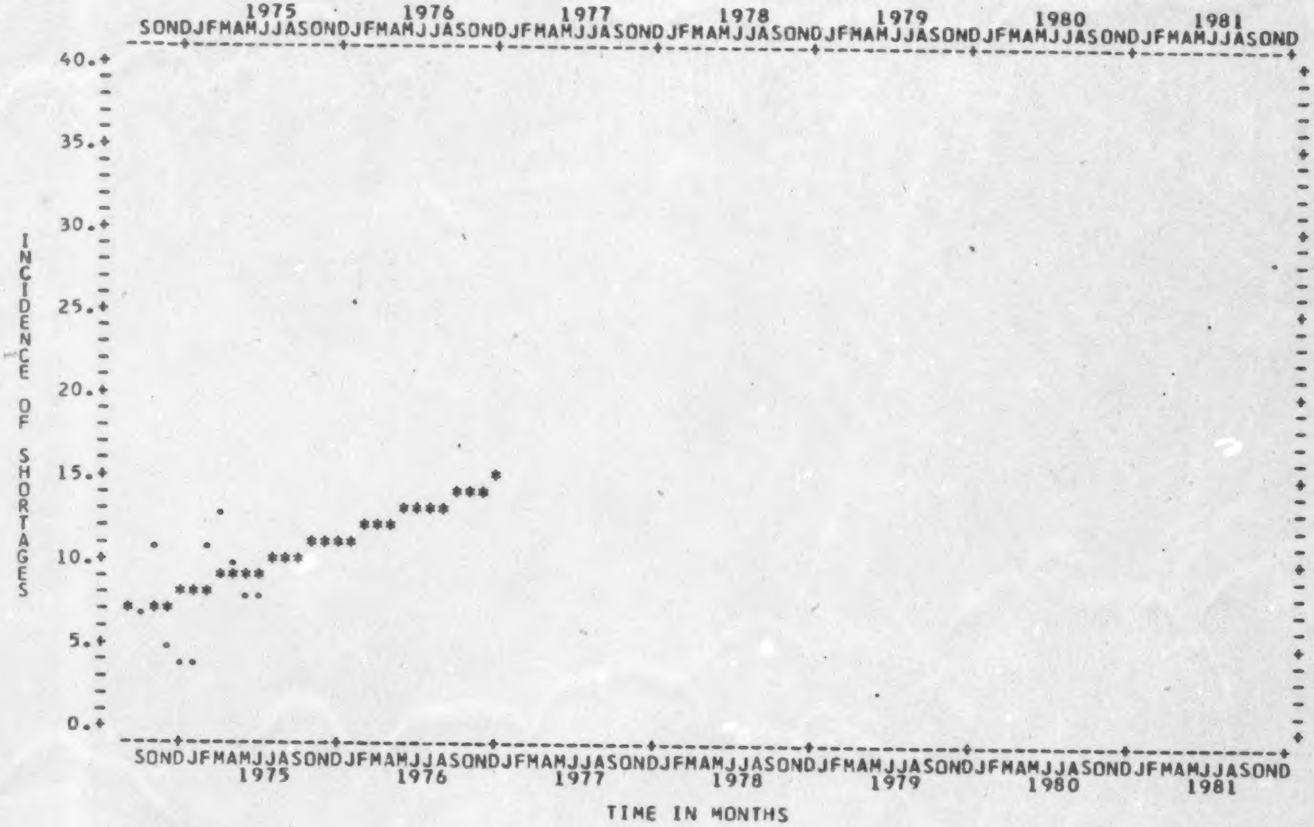
```
LEAST SQUARES TREND LINE      Y      =   1.2000 * (X) +  8.8889          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.7831                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    2.5
STANDARD DEVIATION OF Y       S(Y)   =   4.0
COVARIANCE OF X AND Y         S(XY)_ =   8.0
```

```
FLORICULTURE & ORNAMENTAL HORTICULTURE (TEC DATA)                    07/09/75
```



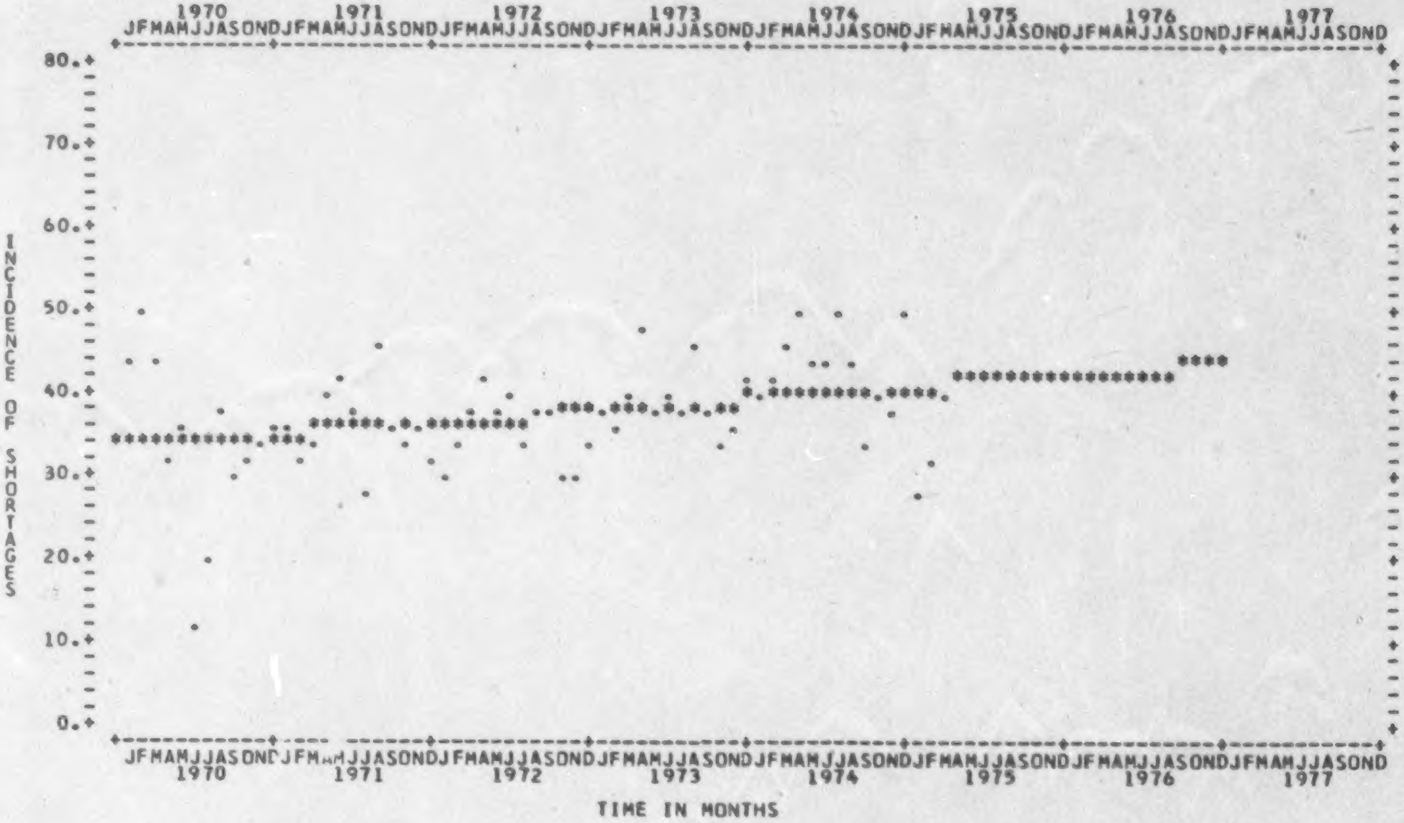
```
LEAST SQUARES TREND LINE      Y      =   0.0520 * (X) +  0.4634        .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.5738                        *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    1.3
STANDARD DEVIATION OF Y       S(Y)   =   1.6
COVARIANCE OF X AND Y         S(XY)  =  17.2
```

FLORICULTURE & ORNAMENTAL HORTICULTURE (CLASSIFIED WANT-ADS DATA)   08/01/75



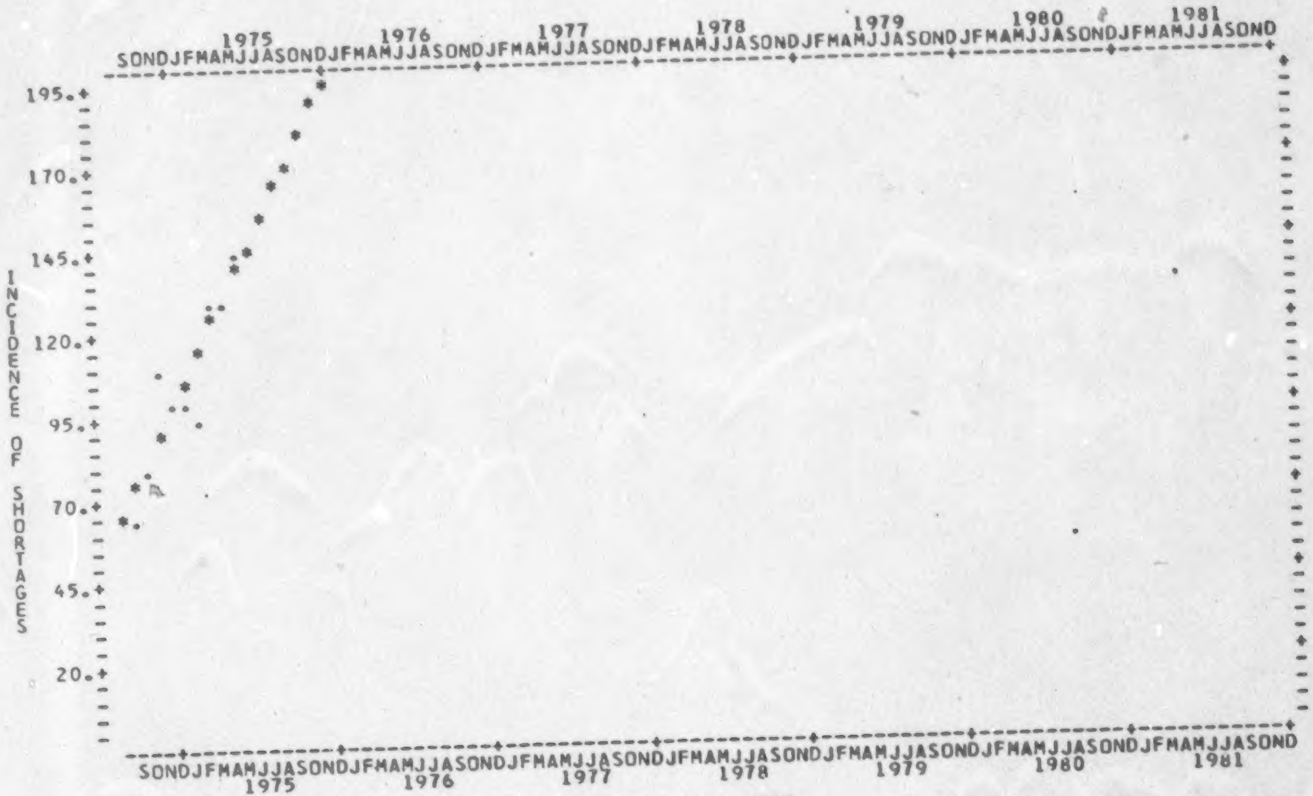
```
LEAST SQUARES TREND LINE       Y      =   0.2848 * (X) +  6.5333         .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R      =   0.2744                         *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=    2.9
STANDARD DEVIATION OF Y        S(Y)  =    3.0
COVARIANCE OF X AND Y          S(XY)_=    2.3
```

```
FOOD SERVICE ADMINASTRATION (TEC DATA)                    06/20/75
```



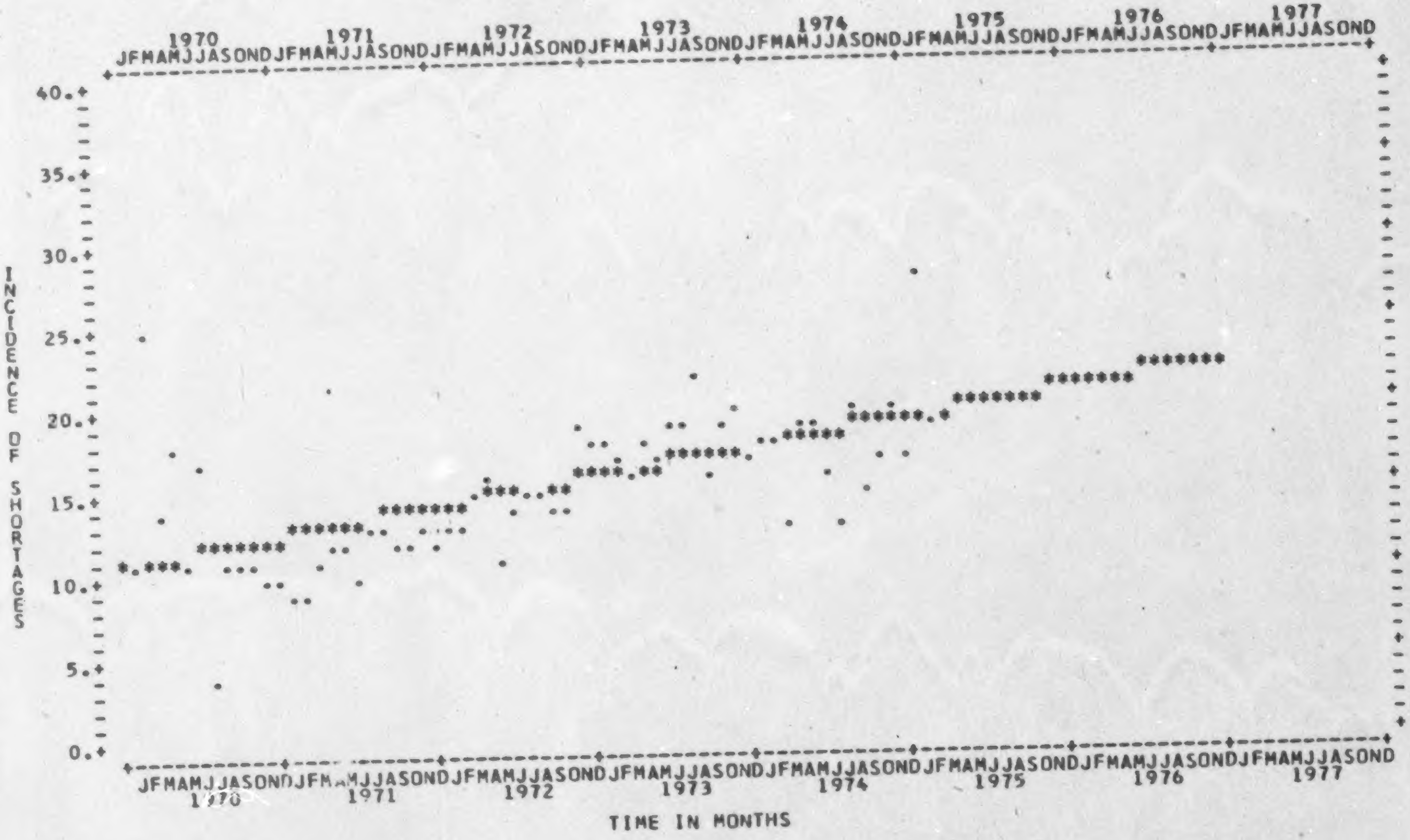
```
LEAST SQUARES TREND LINE     Y      =    0.1226 * (X) + 33.1894          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION   R      =    0.3267                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE   S(Y.X)=     6.4
STANDARD DEVIATION OF Y      S(Y)   =    6.8
COVARIANCE OF X AND Y        S(XY) =    40.5
```

FOOD SERVICE ADMINASTRATION (CLASSIFIED WANT-ADS DATA)   07/11/75



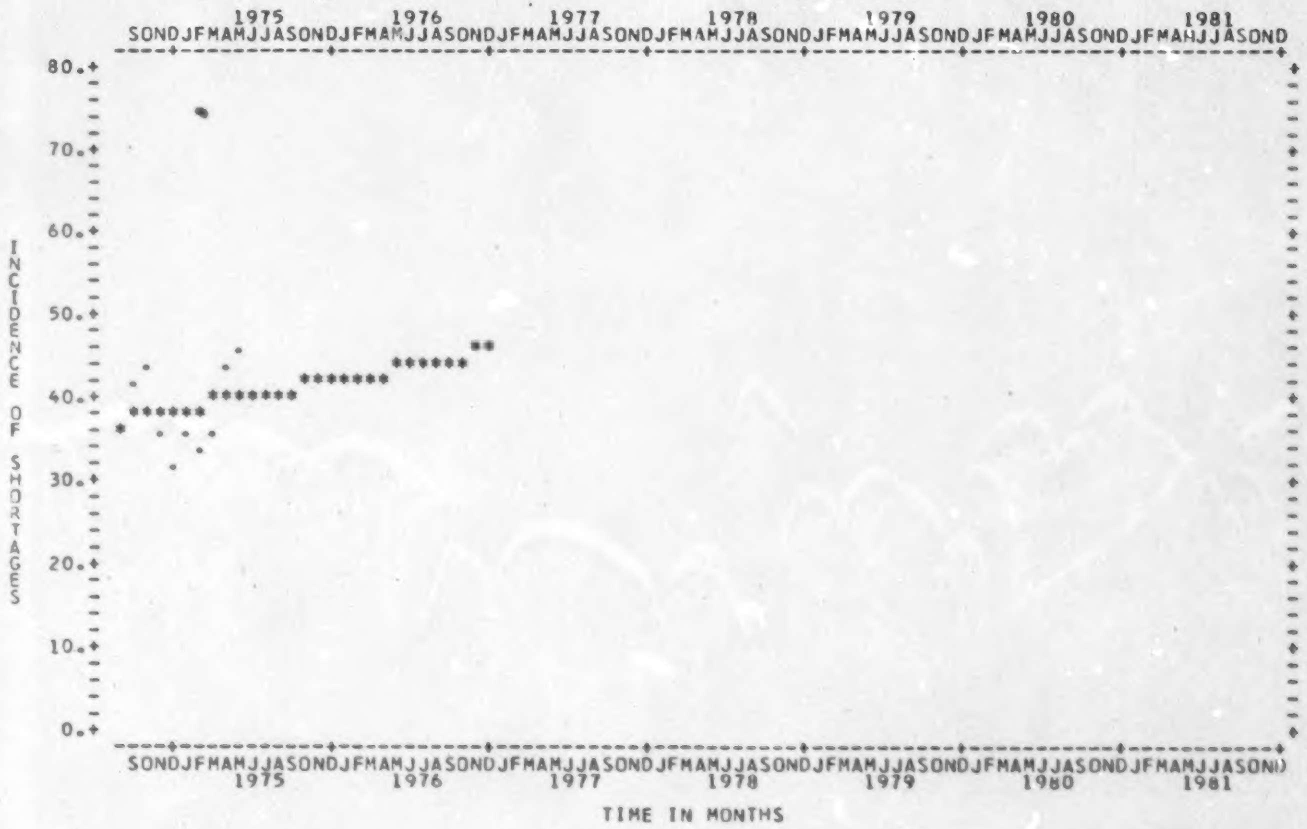
```
LEAST SQUARES TREND LINE      Y      =   8.2000 * (X) + 65.3333      .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.9092                      *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    9.7
STANDARD DEVIATION OF Y       S(Y)   =  23.3
COVARIANCE OF X AND Y         S(XY)  =  54.7
```

GENERAL AUTOMOTIVE CLUSTER (TEC DATA)　　　06/12/75



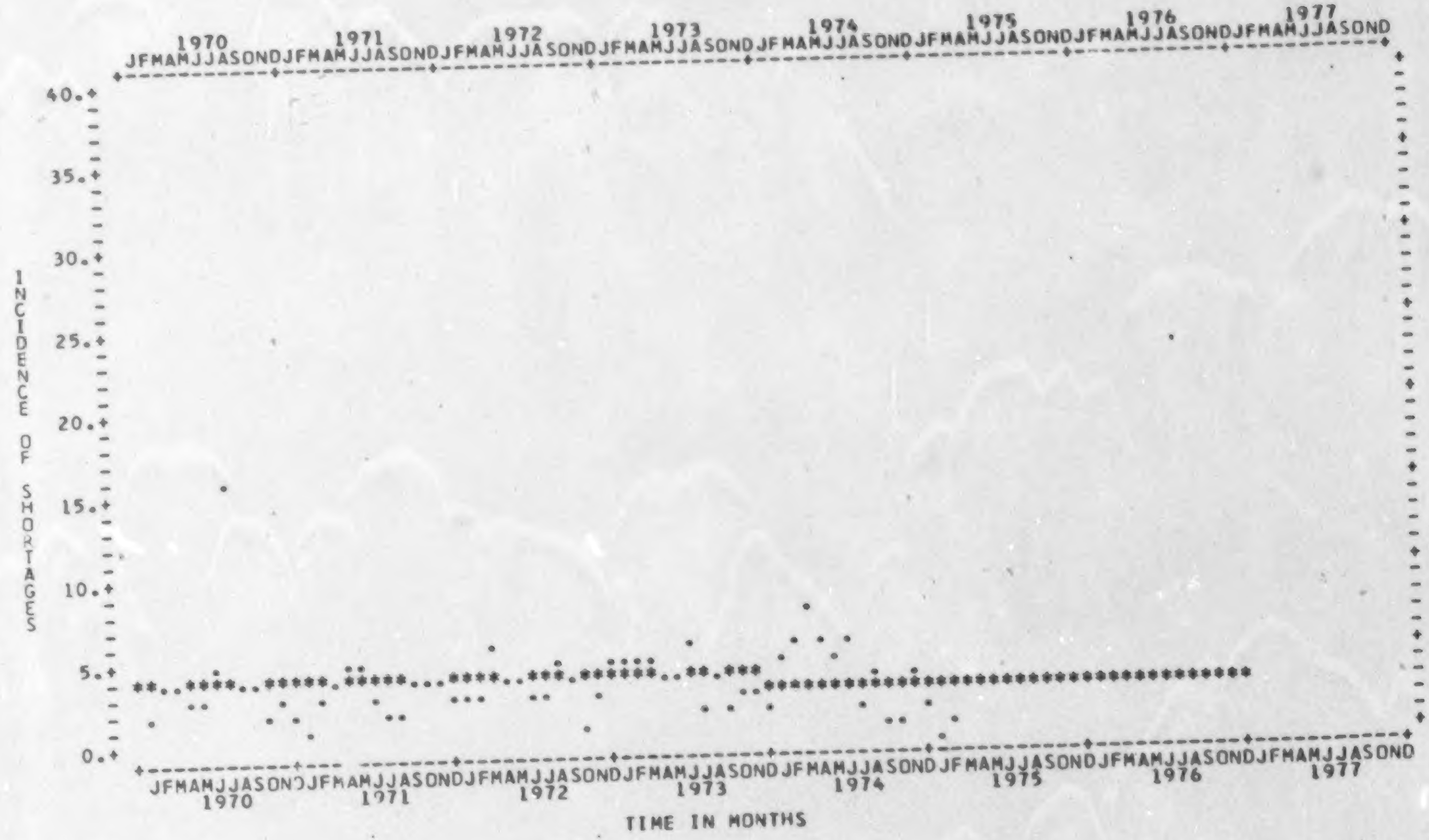
```
LEAST SQUARES TREND LINE      Y       =   0.1378 * (X) + 10.7869        . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R       =   0.6014                        * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=     3.3
STANDARD DEVIATION OF Y       S(Y)    =   4.1
COVARIANCE OF X AND Y         S(XY)   =   44.1
```

GENERAL AUTOMOTIVE CLUSTER (CLASSIFIED WANT-ADS DATA)   07/11/75



```
LEAST SQUARES TREND LINE      Y      =   0.3000 * (X) + 36.9444          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.1634                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    4.7
STANDARD DEVIATION OF Y       S(Y)   =   4.7
COVARIANCE OF X AND Y         S(XY)_ =   2.0
```

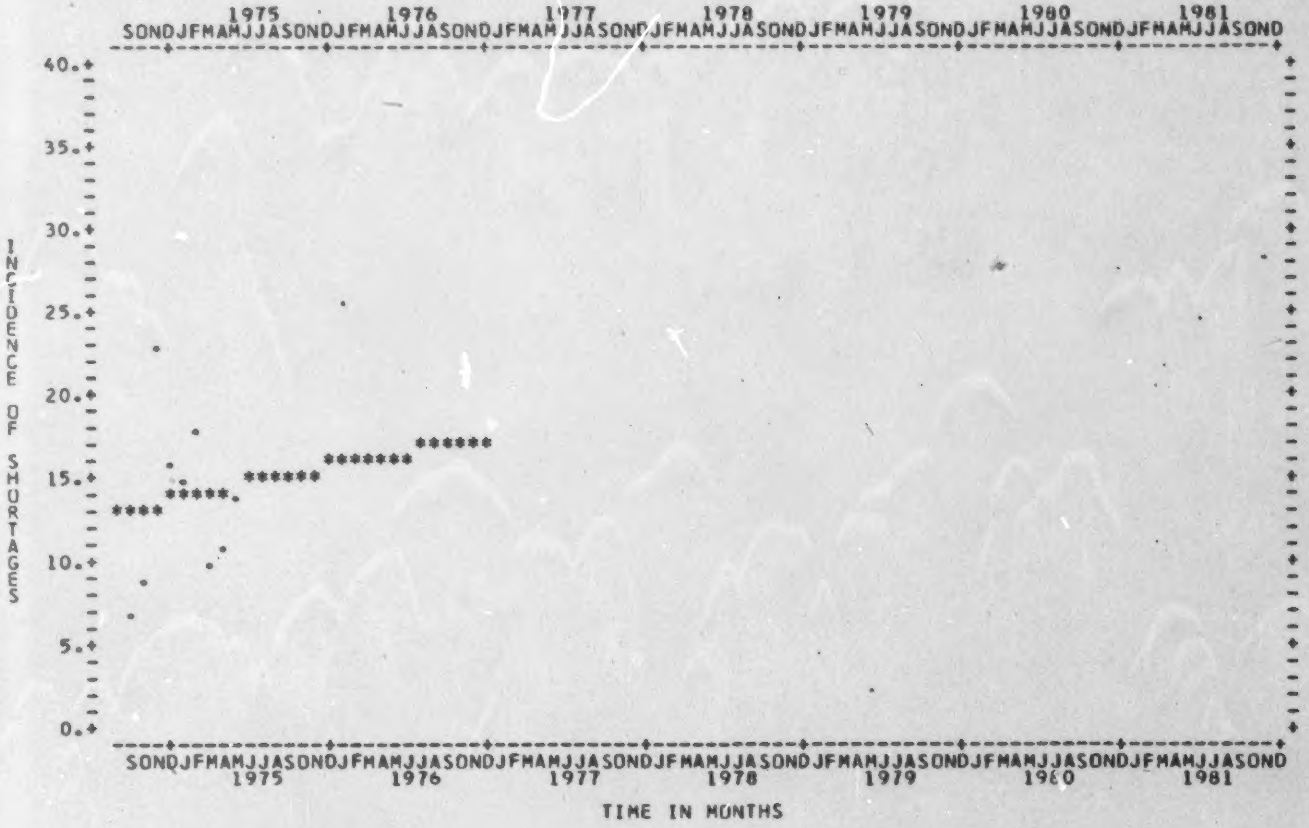
GENERAL PRINTING CLUSTER (TEC DATA) 06/06/75



```
LEAST SQUARES TREND LINE       Y      =   -0.0148 * (X) +  4.2068
COEFFICIENT OF CORRELATION     R      =   -0.1201
STANDARD ERROR OF ESTIMATE     S(Y.X)=     2.2
STANDARD DEVIATION OF Y        S(Y)   =    2.2
COVARIANCE OF X AND Y          S(XY)  =   -4.7
```

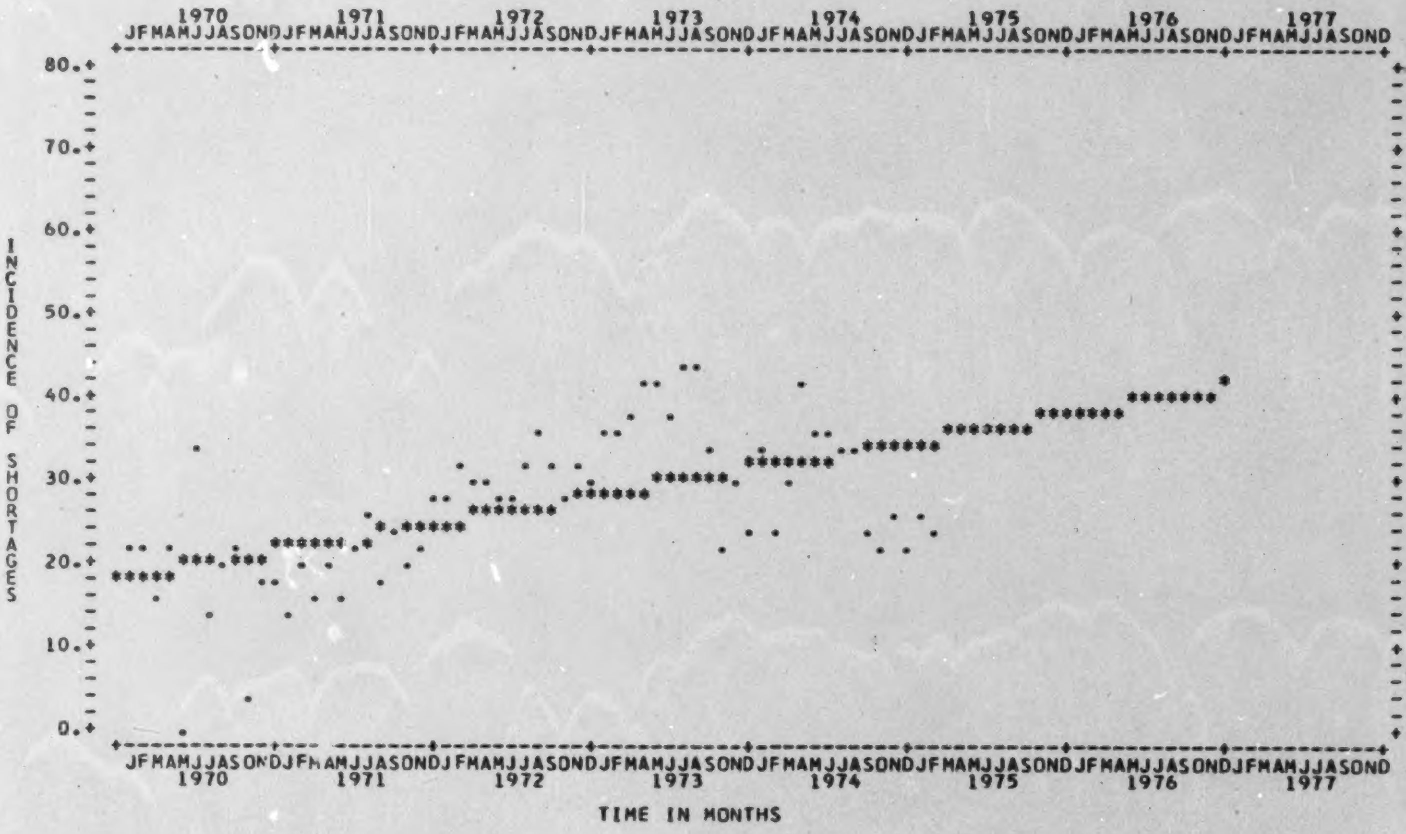
• = HISTORY OF DATA
✱ = CALCULATED DATA

GENERAL PRINTING CLUSTER (CLASSIFIED WANT-ADS DATA)   07/11/75



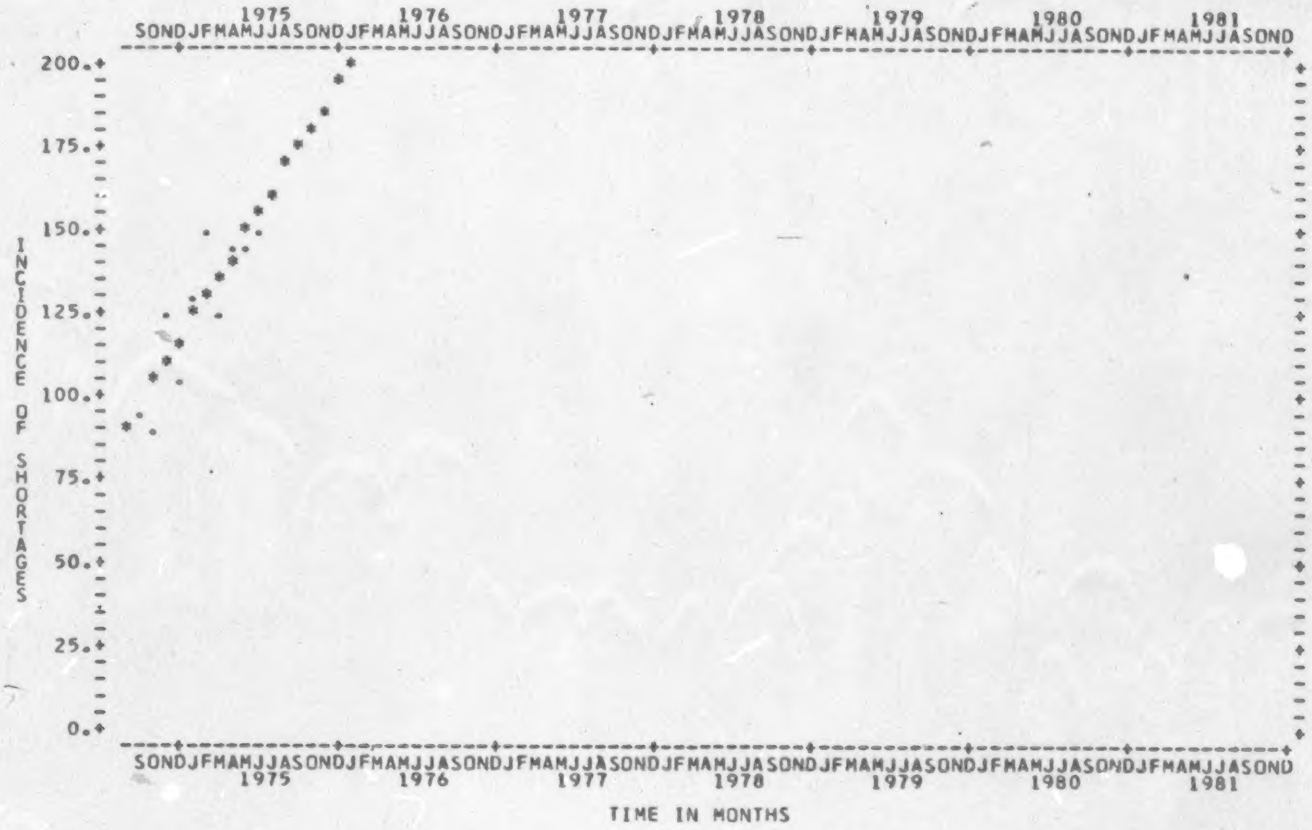
```
LEAST SQUARES TREND LINE      Y       =   0.1667 * (X) + 12.8333         .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R       =   0.0913                         *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=     4.7
STANDARD DEVIATION OF Y       S(Y)   =    4.7
COVARIANCE OF X AND Y         S(XY)_=     1.1
```

GENERAL TECHNOLOGY CLUSTER (TEC DATA) 06/04/75



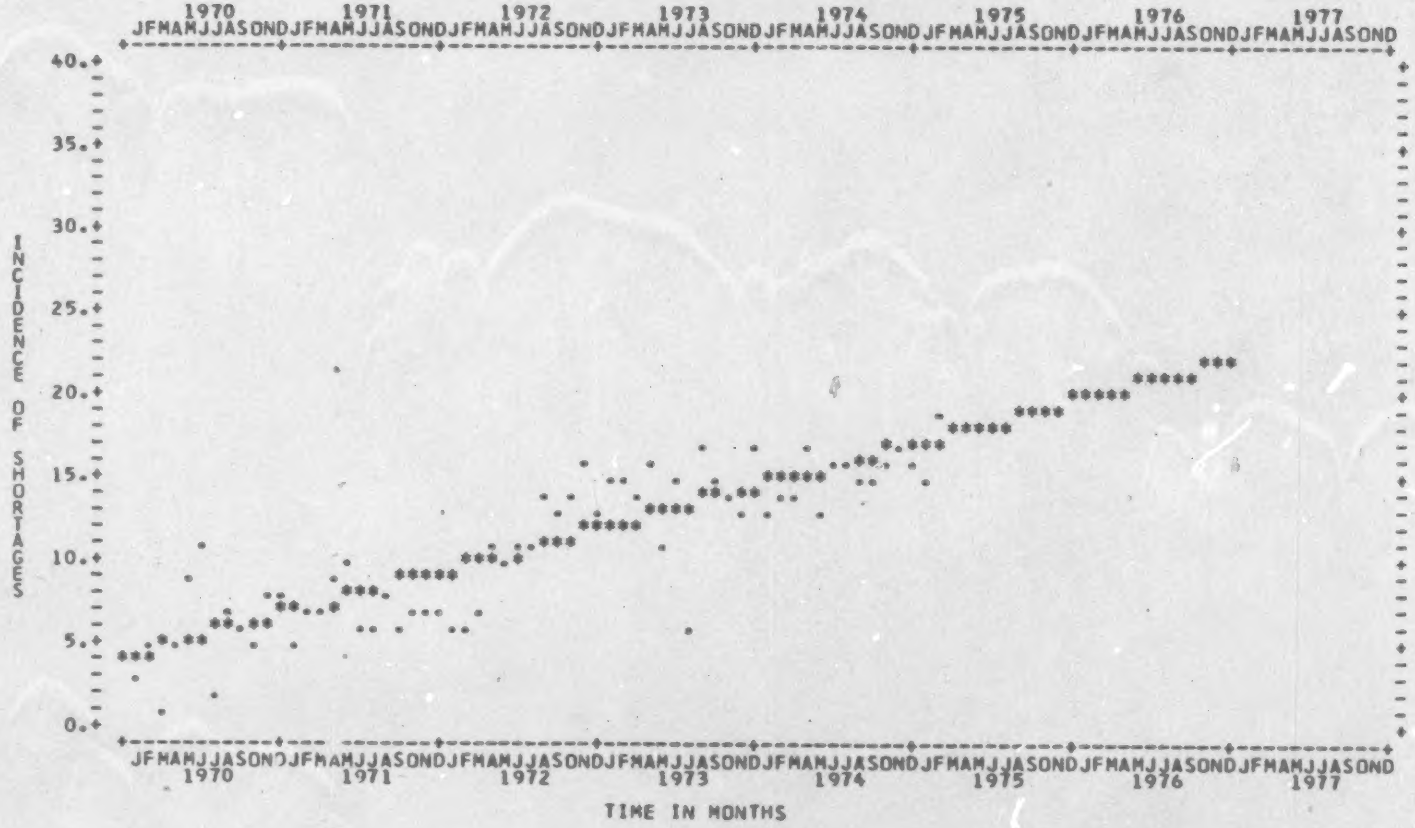
```
LEAST SQUARES TREND LINE     Y      =   0.2788 * (X) + 17.6705           . = HISTORY OF DATA
COEFFICIENT OF CORRELATION   R      =   0.5576                           * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE   S(Y.X)=    7.4
STANDARD DEVIATION OF Y      S(Y)   =   8.9
COVARIANCE OF X AND Y        S(XY) =  89.3
```

GENERAL TECHNOLOGY CLUSTER (CLASSIFIED WANT-ADS DATA)   07/16/75



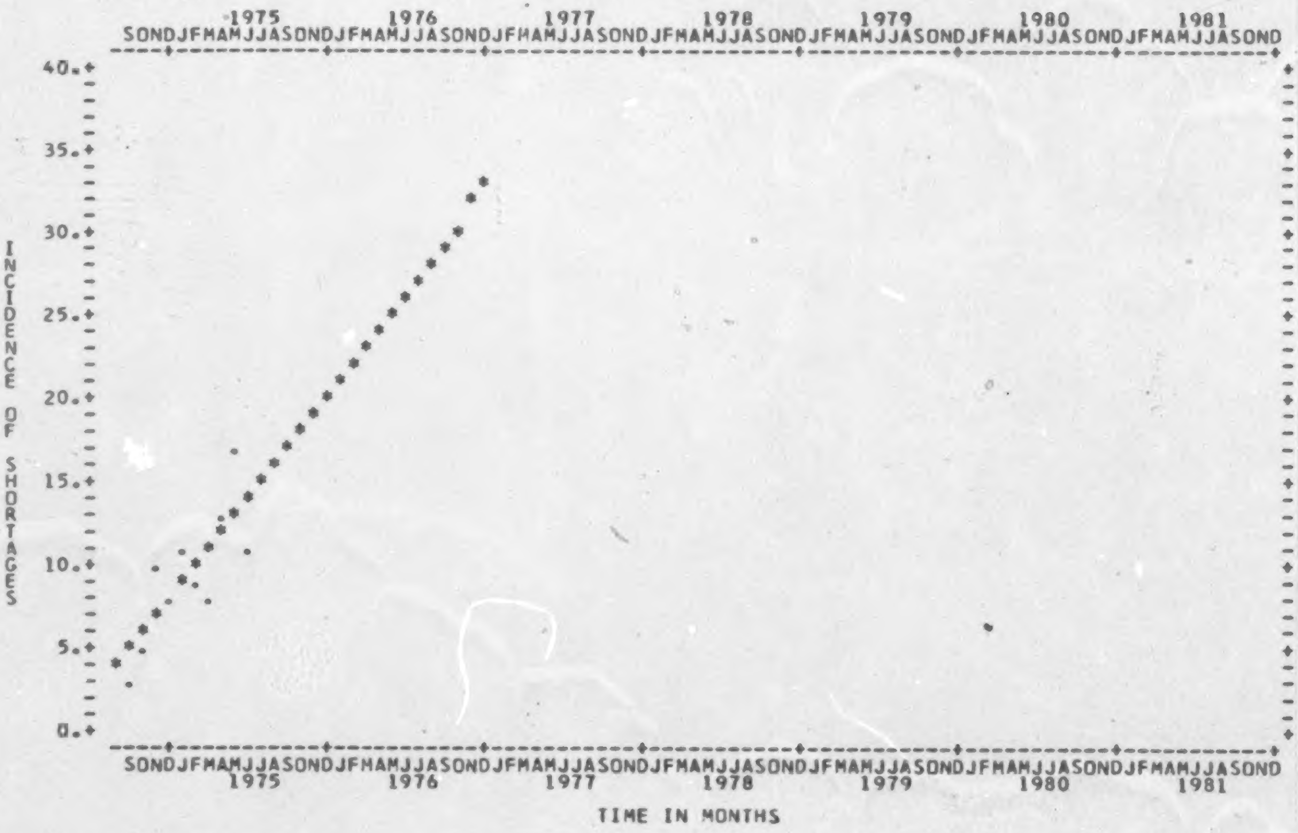
```
LEAST SQUARES TREND LINE     Y      =   6.4242 * (X) + 90.6667          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION   R      =   0.8555                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE   S(Y.X)=   11.2
STANDARD DEVIATION OF Y      S(Y)   =   21.6
COVARIANCE OF X AND Y        S(XY)_=   53.0
```

HEAVY TRUCK MECHANICS CLUSTER (TEC DATA)   06/05/75



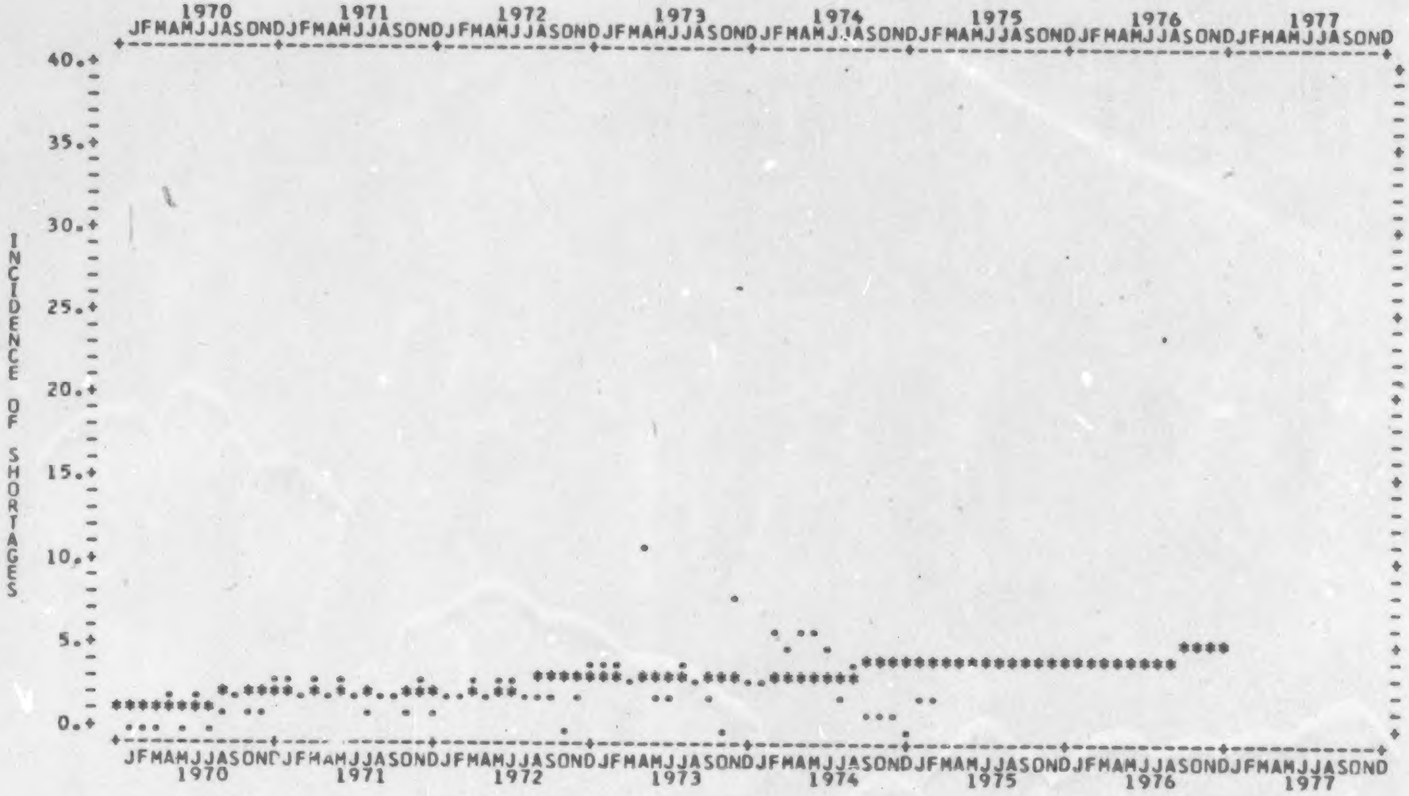
```
LEAST SQUARES TREND LINE       Y      =   0.2154 * (X) +  4.0365          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R      =   0.8569                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=    2.3
STANDARD DEVIATION OF Y        S(Y)   =   4.5
COVARIANCE OF X AND Y          S(XY)  =  69.0
```

HEAVY TRUCK MECHANICS CLUSTER (CLASSIFIED WANT-ADS DATA)   07/16/75



```
LEAST SQUARES TREND LINE       Y      =   1.0242 * (X) +  3.8667       : = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R      =   0.7849                       * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=    2.3
STANDARD DEVIATION OF Y        S(Y)   =   3.7
COVARIANCE OF X AND Y          S(XY)_ =   8.4
```

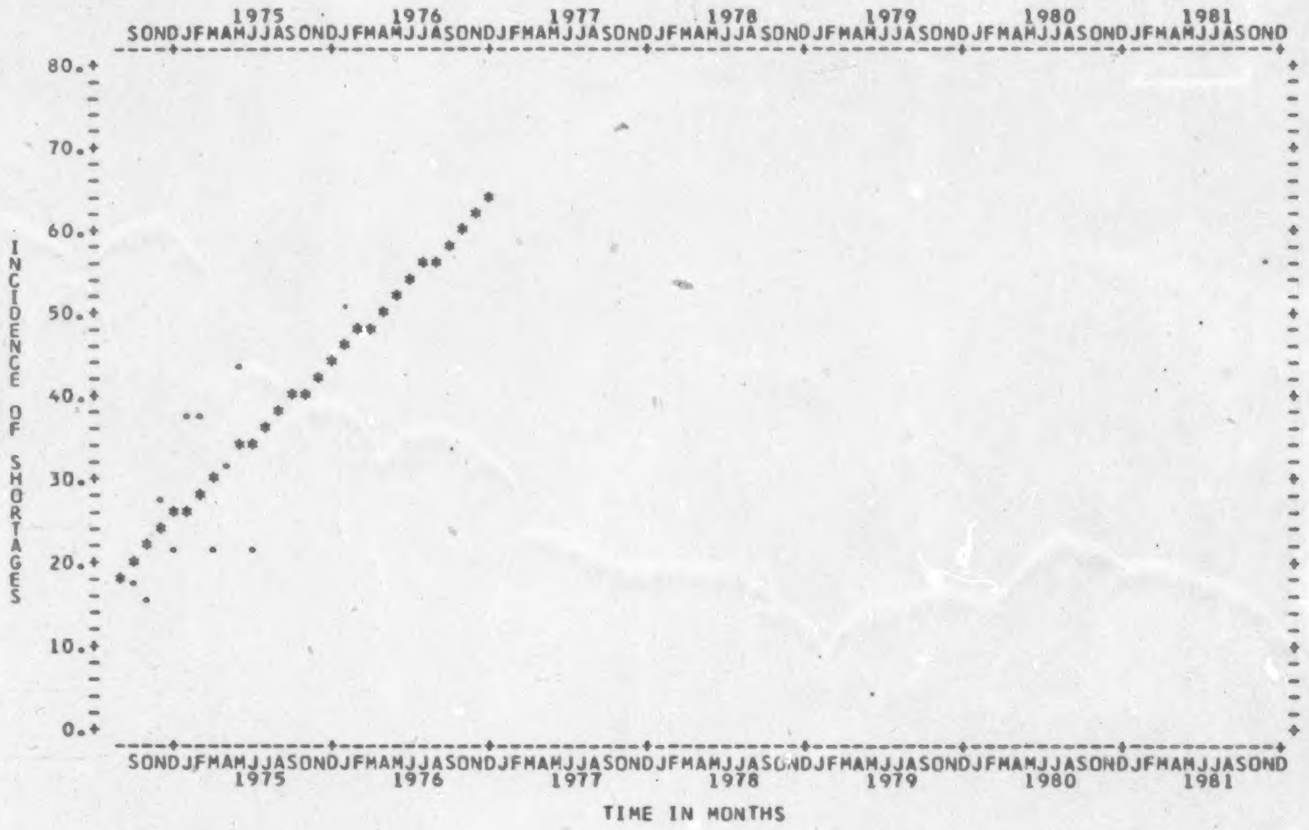
INSTRUCTIONAL MEDIA TECHNOLOGY (TEC DATA)   06/06/75



TIME IN MONTHS

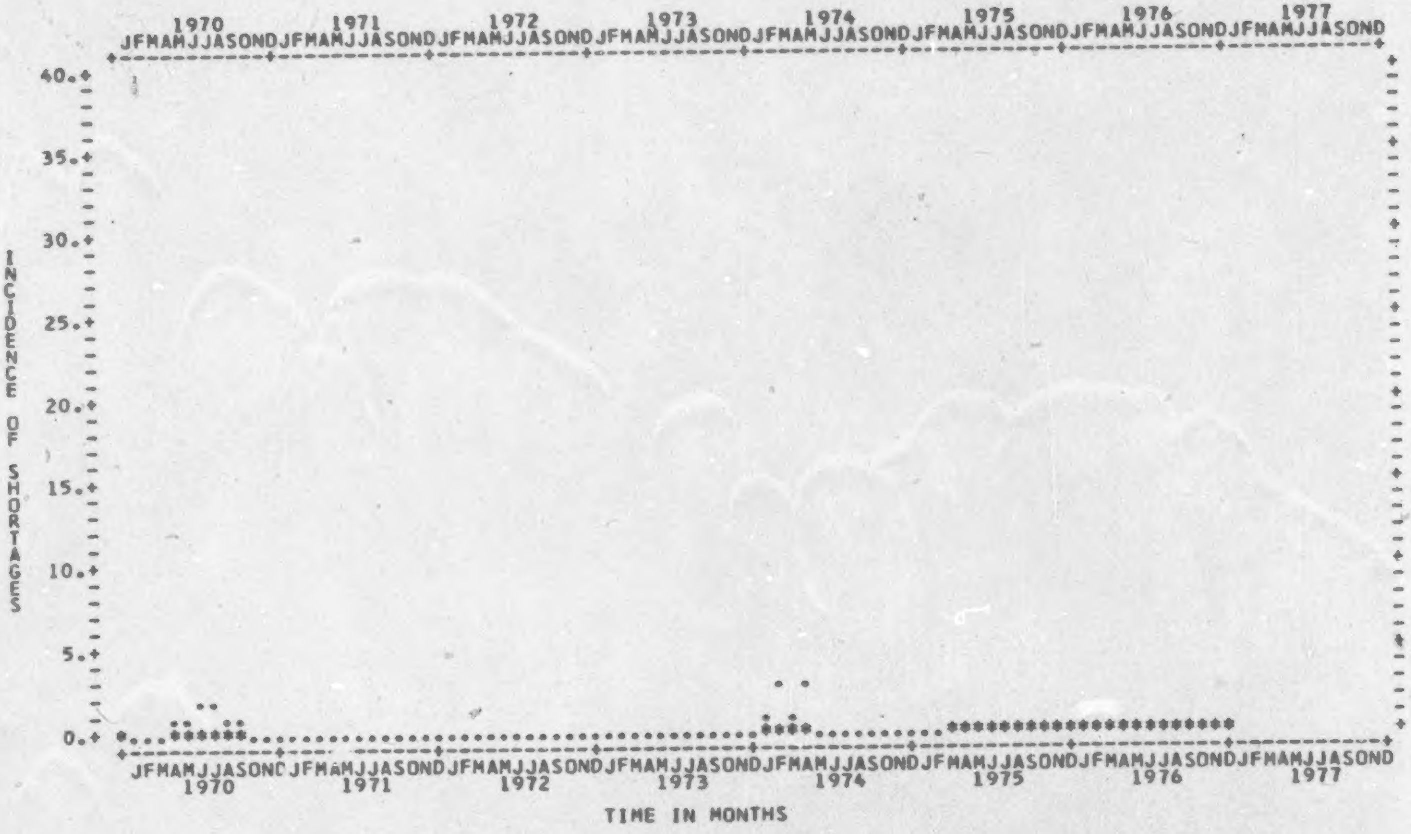
```
LEAST SQUARES TREND LINE      Y      =  0.0410 * (X) + 1.1925      . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =  0.3717                     * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=  1.8
STANDARD DEVIATION OF Y       S(Y)   =  2.0
COVARIANCE OF X AND Y         S(XY)  = 13.1
```

INSTRUCTIONAL MEDIA TECHNOLOGY CLUSTER (CLASSIFIED WANT-ADS DATA)   07/16/75



```
LEAST SQUARES TREND LINE       Y       =    1.5818 * (X) + 18.8000         .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R       =    0.5010                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=      7.8
STANDARD DEVIATION OF Y        S(Y)   =     9.1
COVARIANCE OF X AND Y          S(XY)_ =    13.0
```

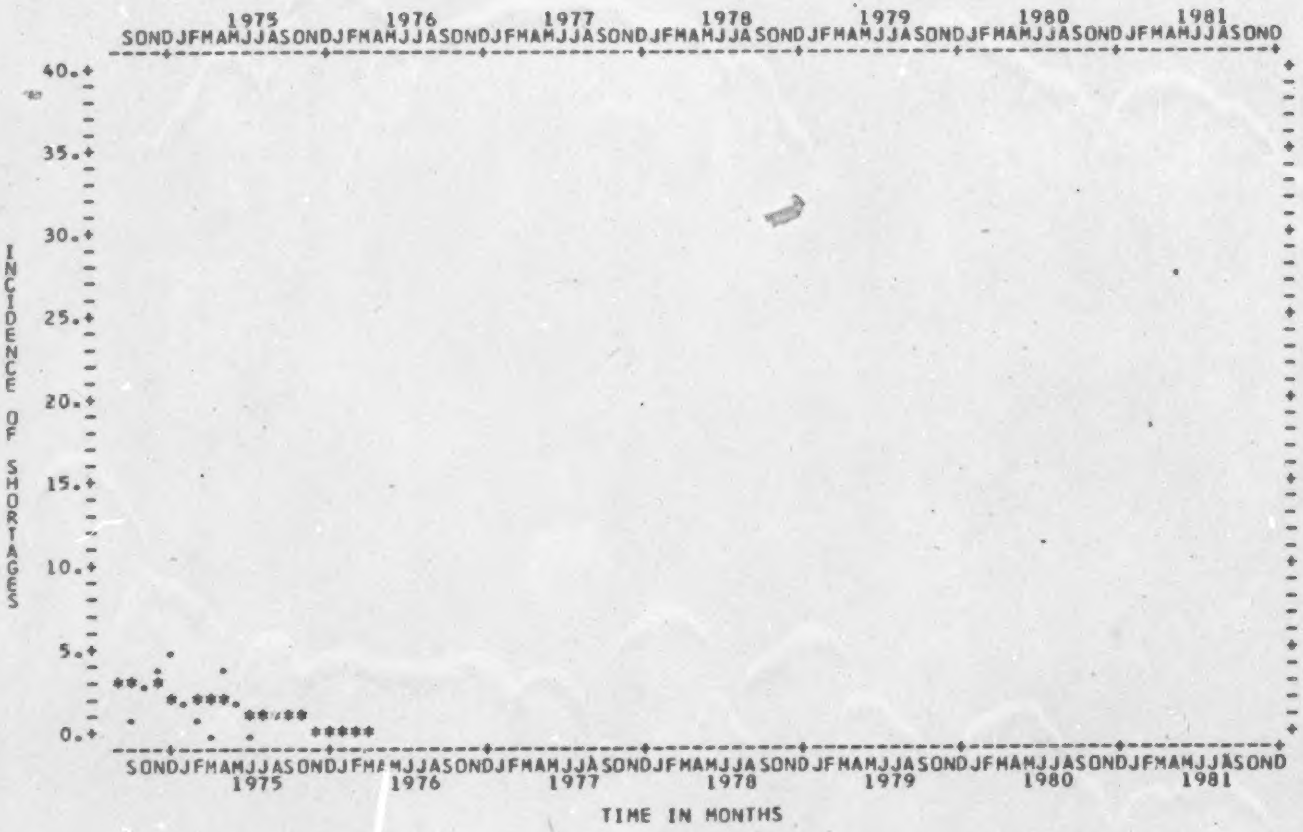
INSTRUMENTATION TECHNOLOGY CLUSTER (TEC DATA)   06/05/75



```
LEAST SQUARES TREND LINE       Y      =  -0.0023 * (X) +  0.3310
COEFFICIENT OF CORRELATION     R      =  -0.0618
STANDARD ERROR OF ESTIMATE     S(Y.X)=   0.7
STANDARD DEVIATION OF Y        S(Y)  =   0.7
COVARIANCE OF X AND Y          S(XY) =  -0.7
```

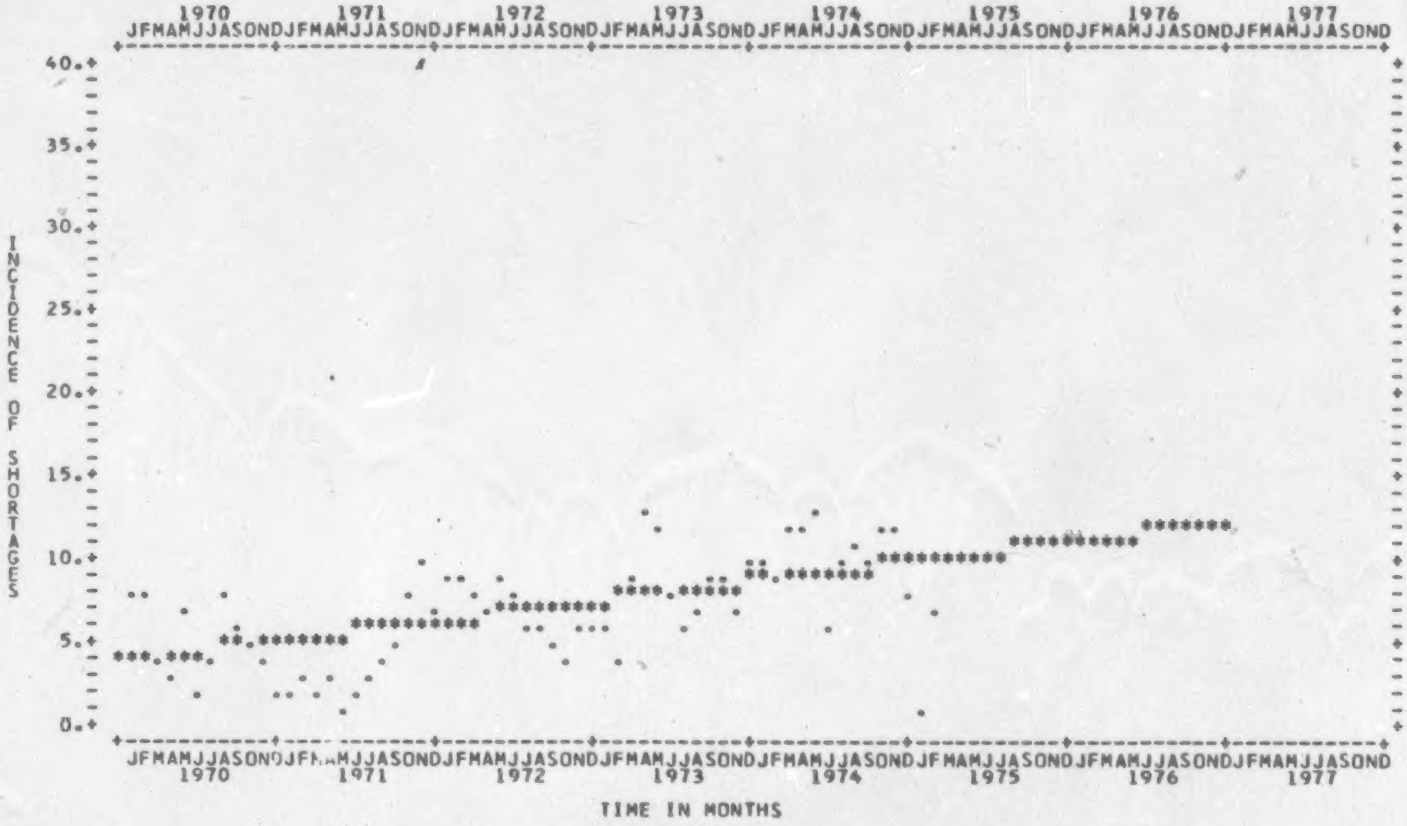
```
: = HISTORY OF DATA
* = CALCULATED DATA
```

INSTRUMENTATION TECHNOLOGY CLUSTER (CLASSIFIED WANT-ADS DATA) 07/16/75



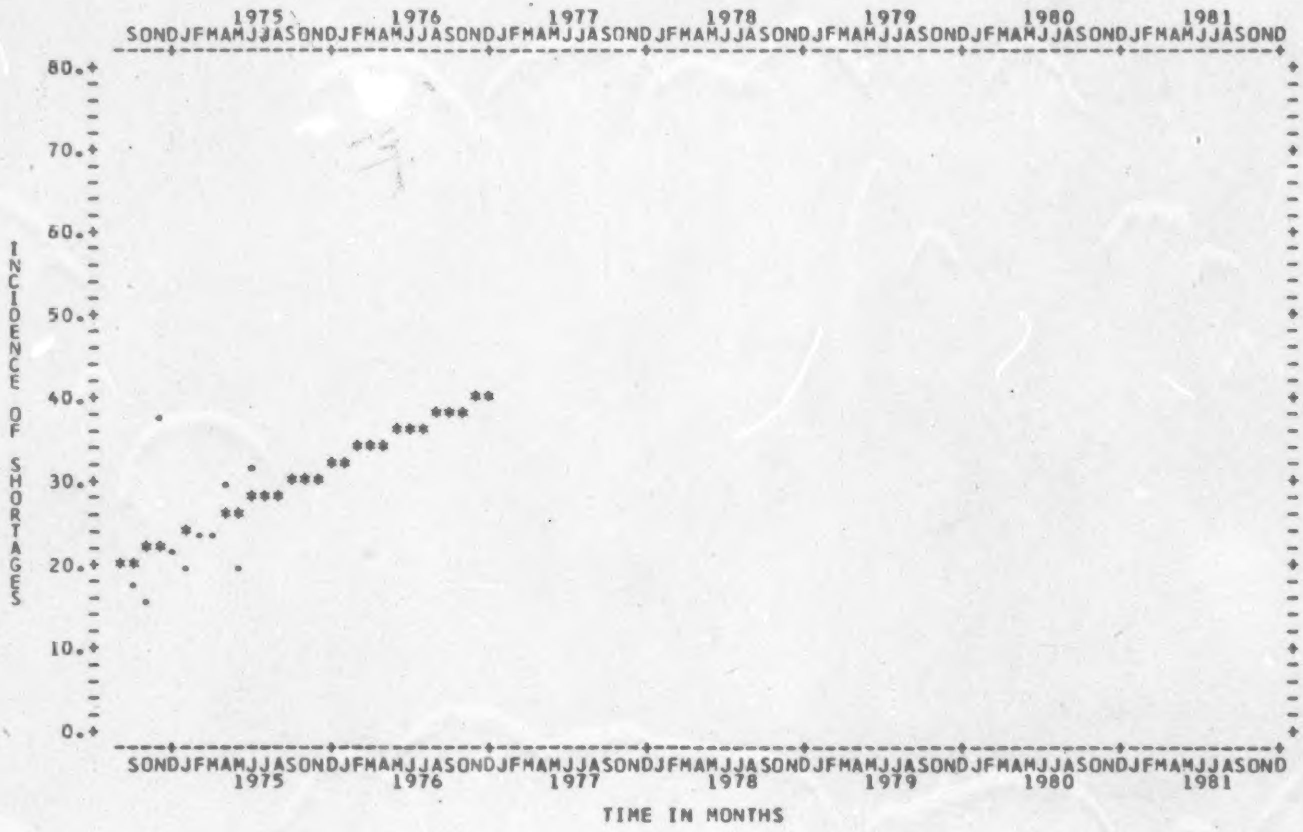
```
LEAST SQUARES TREND LINE      Y      =  -0.1939 * (X) +  3.2667         . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =  -0.3353                         * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    1.6
STANDARD DEVIATION OF Y       S(Y)  =    1.7
COVARIANCE OF X AND Y         S(XY)_=  -1.6
```

```
LASER TECHNOLOGY CLUSTER (TEC DATA)                    06/06/75
```



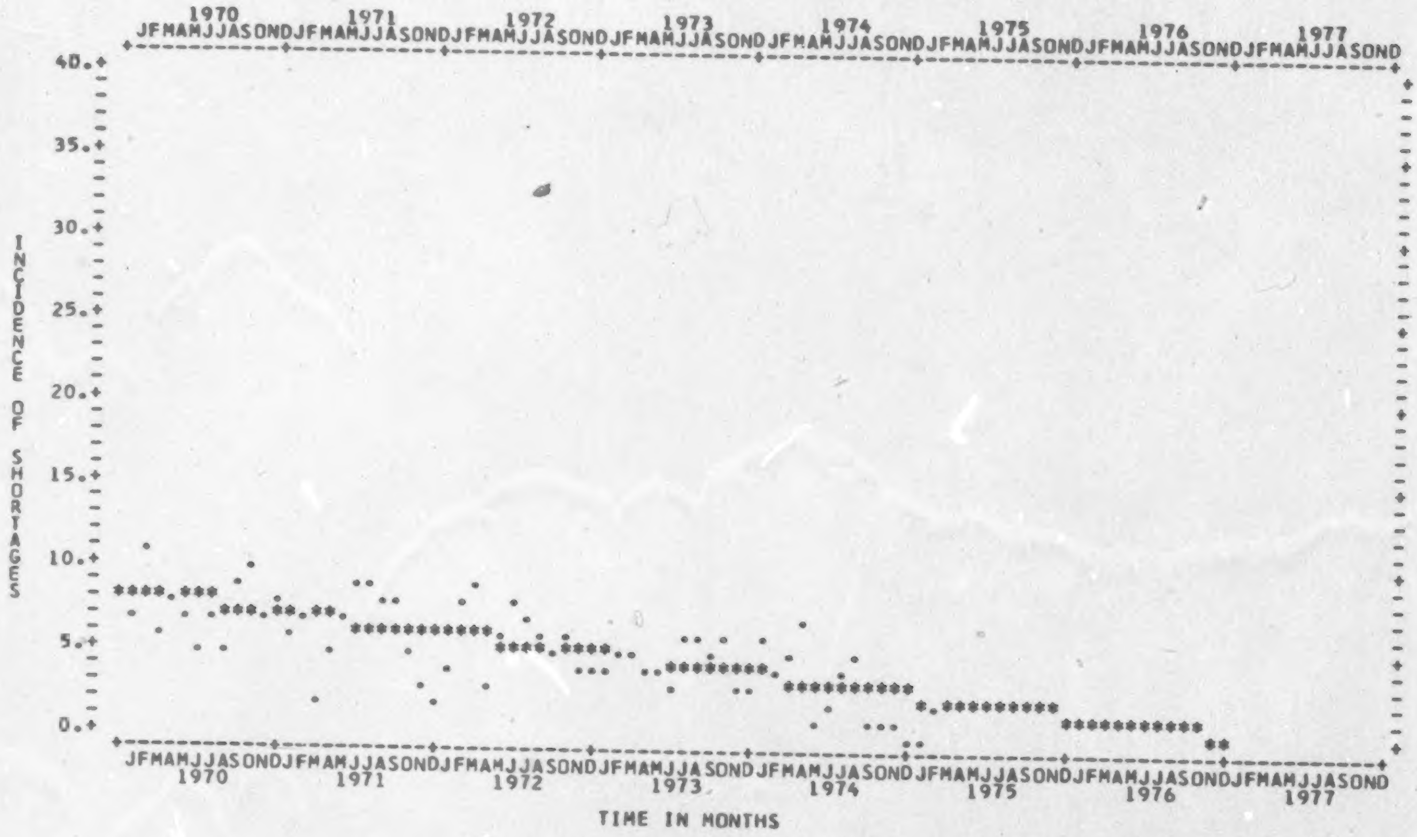
```
LEAST SQUARES TREND LINE     Y      =   0.0993 * (X) +  3.7594          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION   R      =   0.5582                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE   S(Y.X)=   2.6
STANDARD DEVIATION OF Y      S(Y)   =   3.2
COVARIANCE OF X AND Y        S(XY)  =  31.8
```

```
LASER TECHNOLOGY CLUSTER (CLASSIFIED WANT-ADS DATA)                    07/16/75
```



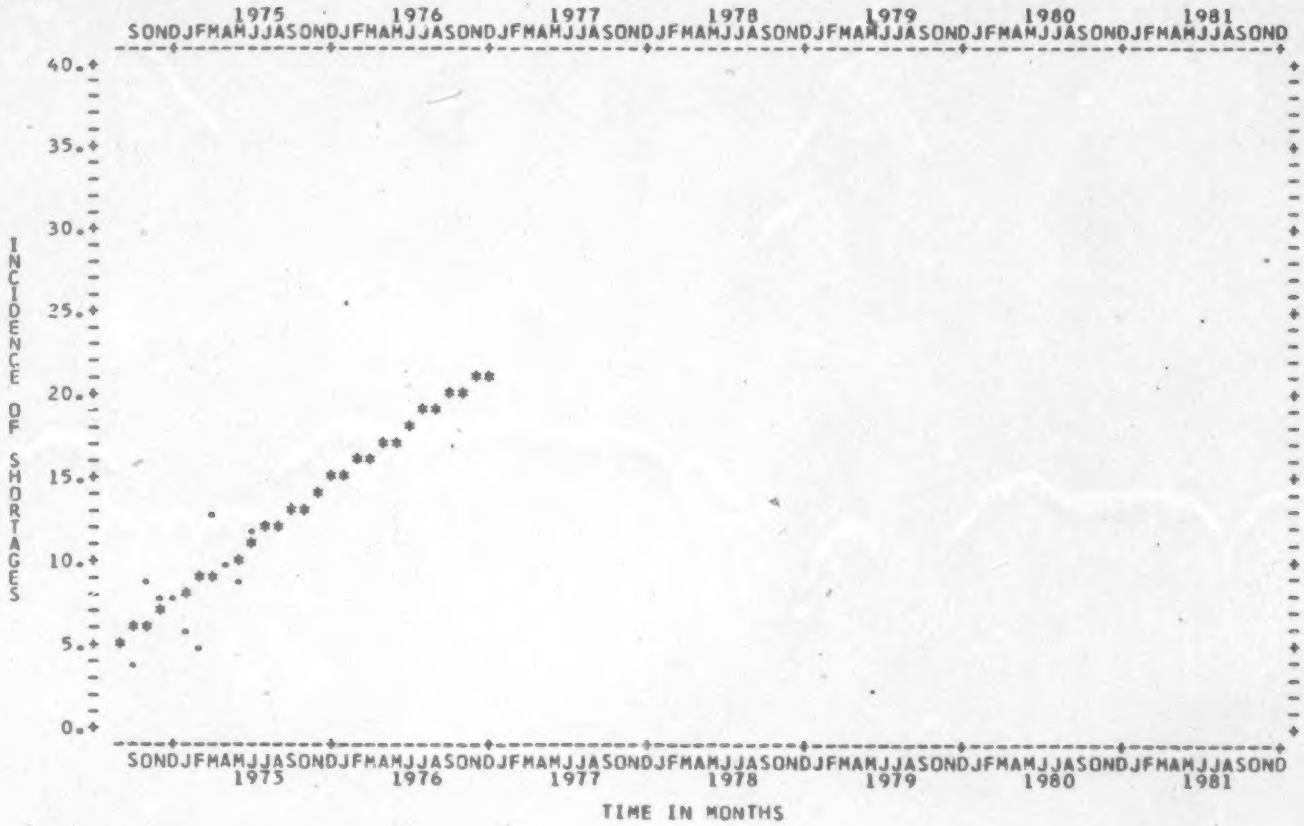
```
LEAST SQUARES TREND LINE      Y      =   0.7333 * (X) + 19.8667          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.3247                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    6.1
STANDARD DEVIATION OF Y       S(Y)   =   6.5
COVARIANCE OF X AND Y         S(XY)_=    6.0
```

LIVESTOCK & RANCH MGT CLUSTER (TEC DATA)   06/06/75



```
LEAST SQUARES TREND LINE        Y      =  -0.0933 * (X) +  8.1639      . = HISTORY OF DATA
COEFFICIENT OF CORRELATION      R      =  -0.6614                       * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE      S(Y.X)=    1.9
STANDARD DEVIATION OF Y         S(Y)   =   2.5
COVARIANCE OF X AND Y           S(XY) = -29.9
```

LIVESTOCK & RANCH MGT CLUSTER (CLASSIFIED WANT-ADS DATA) 07/16/75

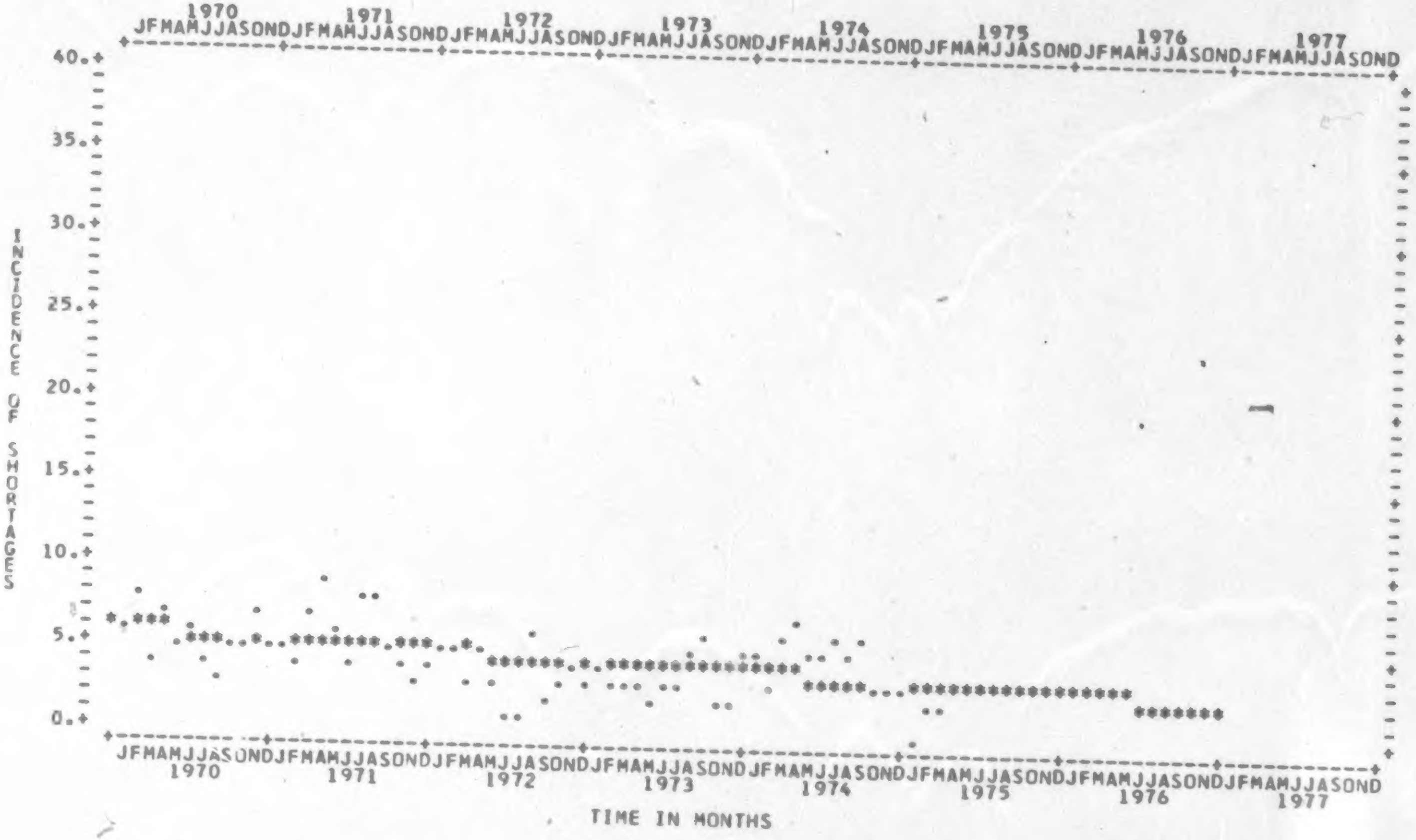


```
LEAST SQUARES TREND LINE      Y      =   0.5818 * (X) +  5.2000
COEFFICIENT OF CORRELATION    R      =   0.6127
STANDARD ERROR OF ESTIMATE    S(Y.X)=    2.2
STANDARD DEVIATION OF Y       S(Y)   =   2.7
COVARIANCE OF X AND Y         S(XY)_ =   4.8
```

```
.  = HISTORY OF DATA
*  = CALCULATED DATA
```

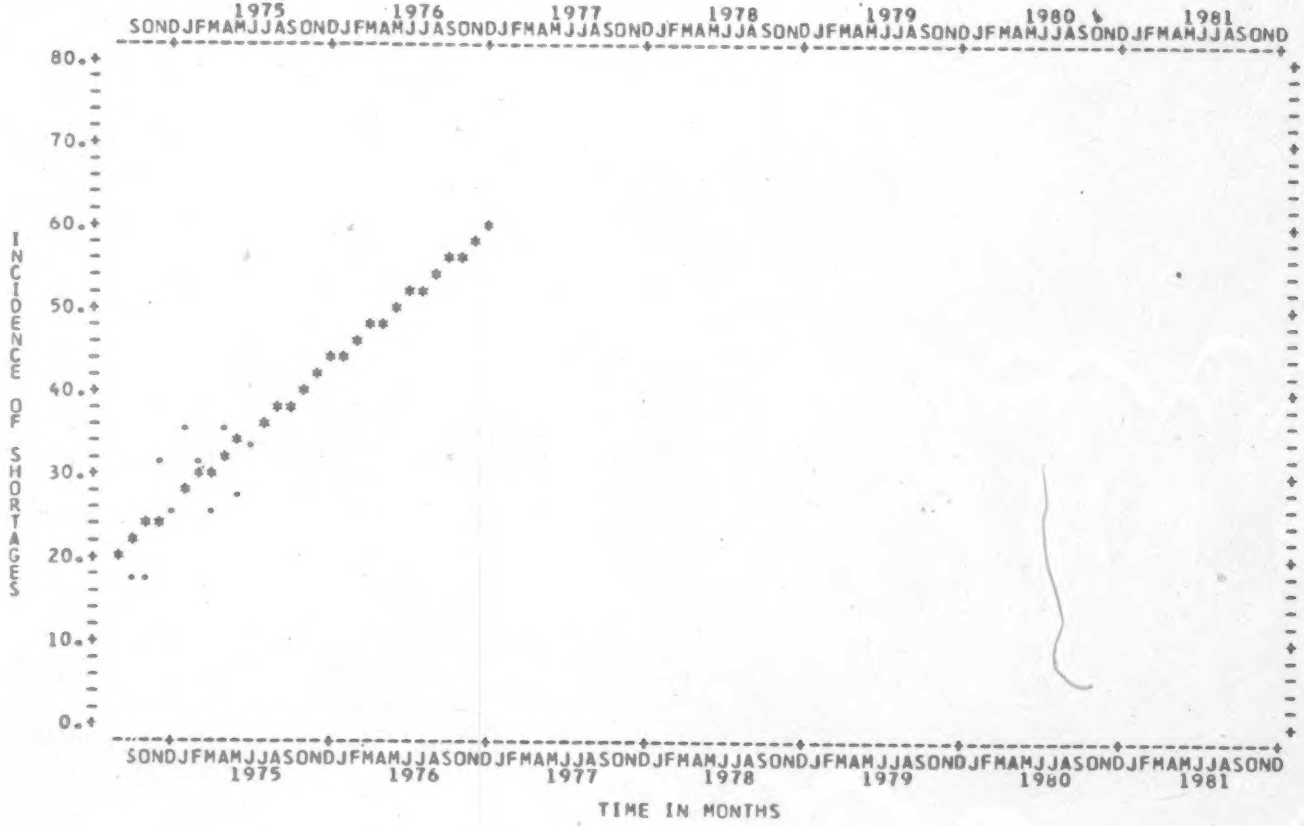
MEAT PROCESSING & MARKETING (TEC DATA)

06/20/75



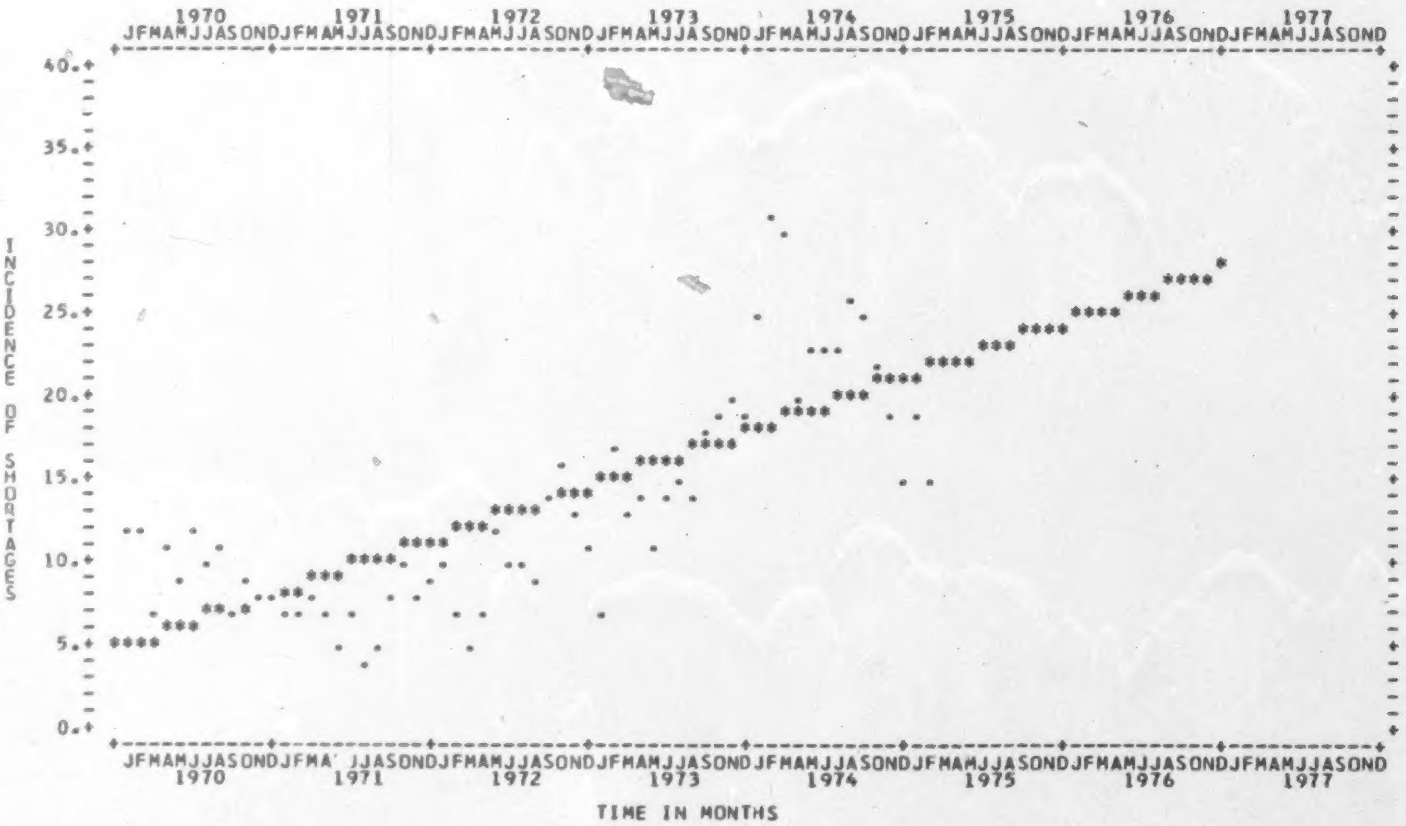
```
LEAST SQUARES TREND LINE       Y       =  -0.0414 * (X) +  5.6892
COEFFICIENT OF CORRELATION     R       =  -0.4021                          : = HISTORY OF DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=    1.7                              * = CALCULATED DATA
STANDARD DEVIATION OF Y        S(Y)    =   1.9
COVARIANCE OF X AND Y          S(XY) = -13.7
```

MEAT PROCESSING & MARKETING (CLASSIFIED WANT-ADS DATA)   07/25/75



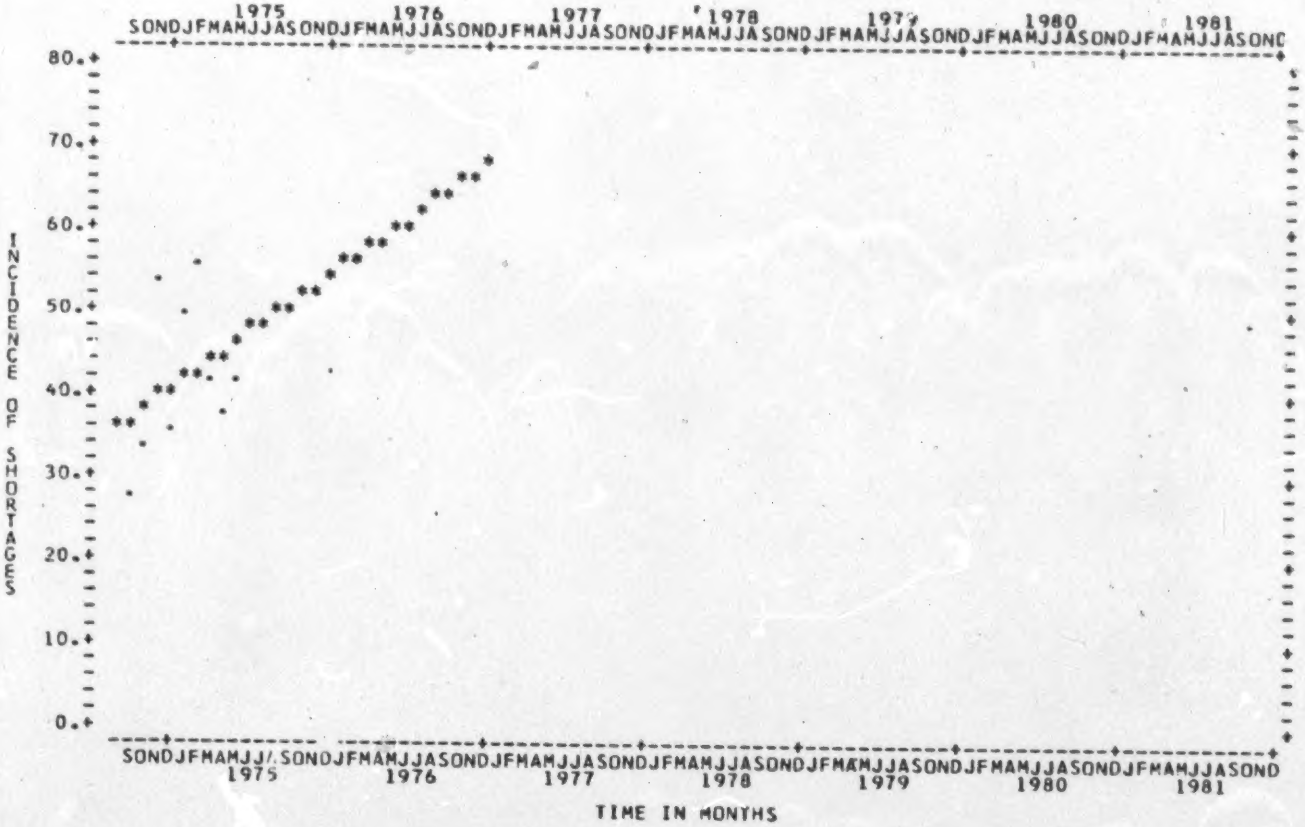
```
LEAST SQUARES TREND LINE      Y      =   1.3939 * (X) + 20.7333            .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.6235                            *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    5.0
STANDARD DEVIATION OF Y       S(Y)   =   6.4
COVARIANCE OF X AND Y         S(XY)  =   11.5
```

MECHANICAL DRAWING CLUSTER (TEC DATA)   06/02/75



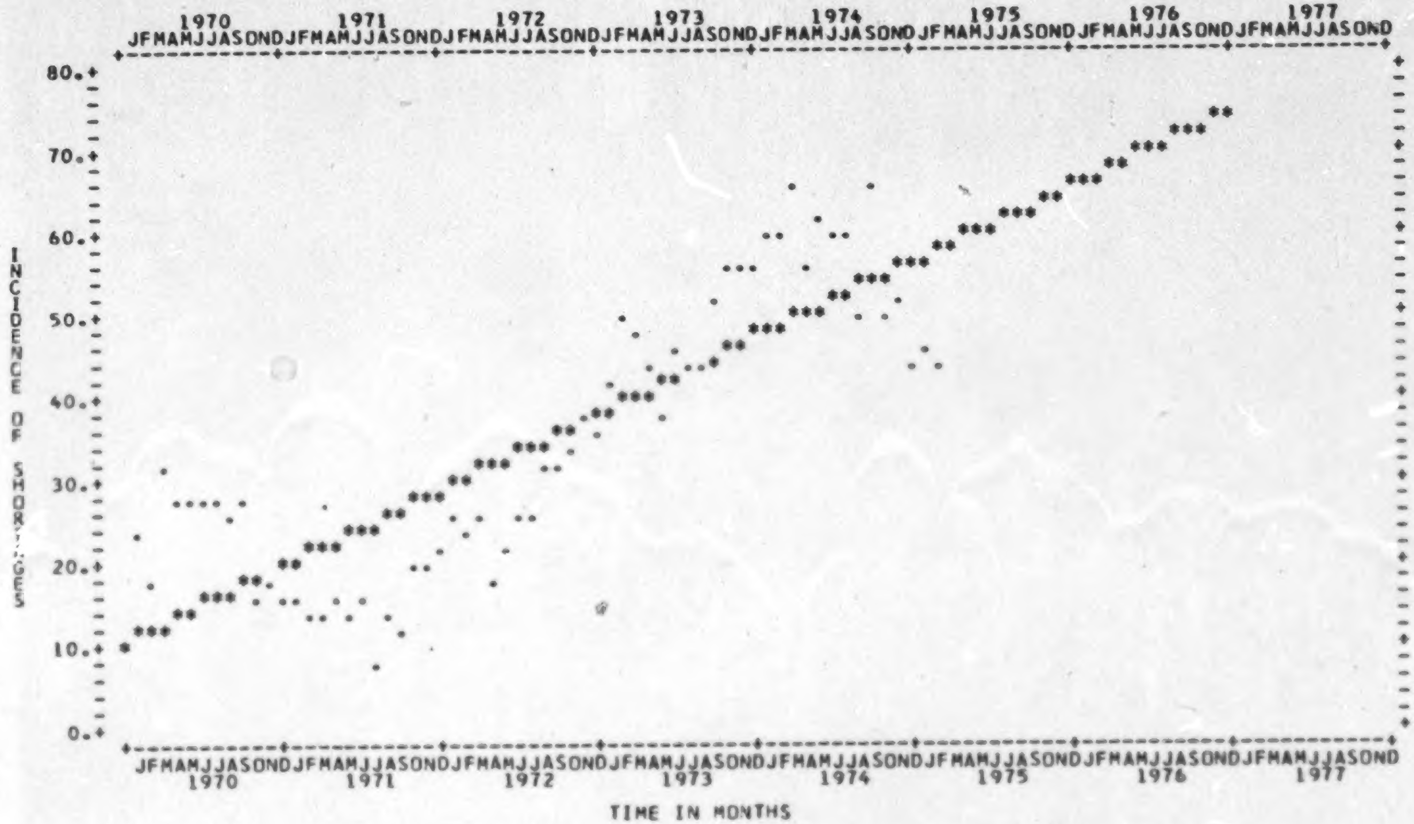
```
LEAST SQUARES TREND LINE       Y      =   0.2734 * (X) +  4.6467          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R      =   0.7546                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=    4.3
STANDARD DEVIATION OF Y        S(Y)   =   6.5
COVARIANCE OF X AND Y          S(XY)  =  87.5
```

MECHANICAL DRAWING CLUSTER (CLASSIFIED WANT-ADS DATA)   07/09/75



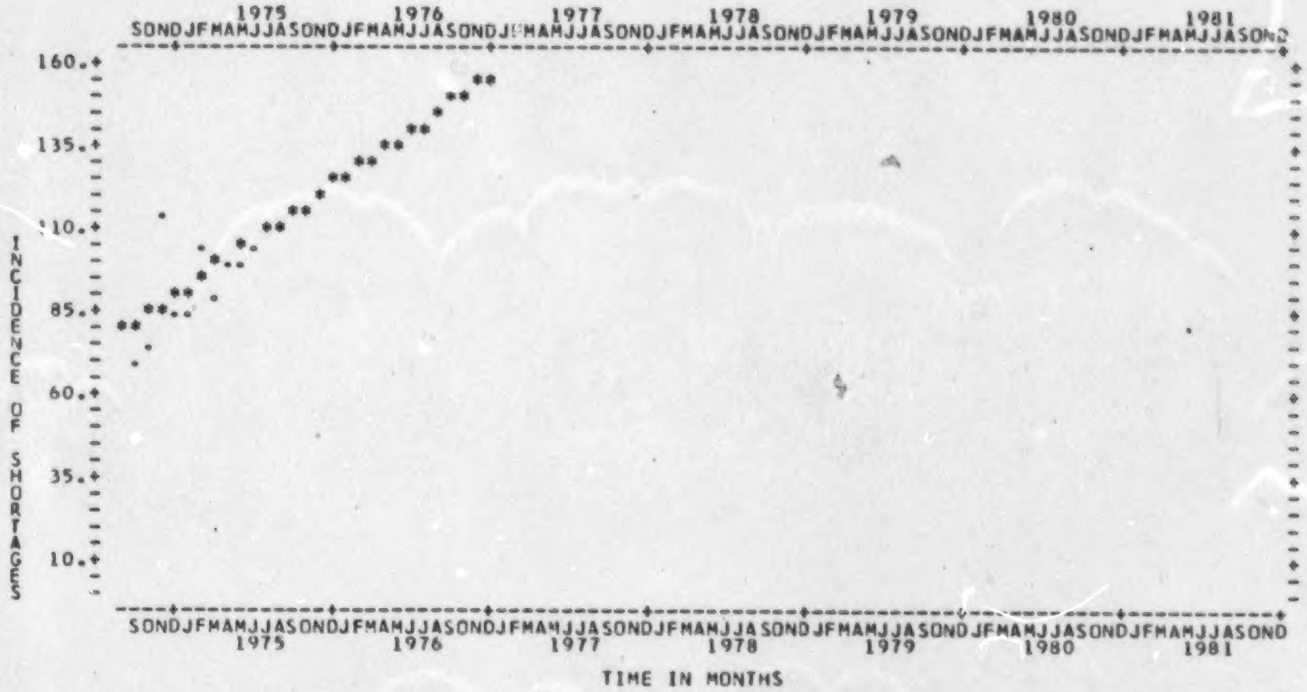
```
LEAST SQUARES TREND LINE      Y      =   1.1500 * (X) + 35.6944       :  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.3347                       *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    8.4
STANDARD DEVIATION OF Y       S(Y)   =   8.9
COVARIANCE OF X AND Y         S(XY)  =   7.7
```

MECHANICAL TECHNOLOGY/MACHINE SHOP OPERATIONS (TEC DATA)   06/04/75



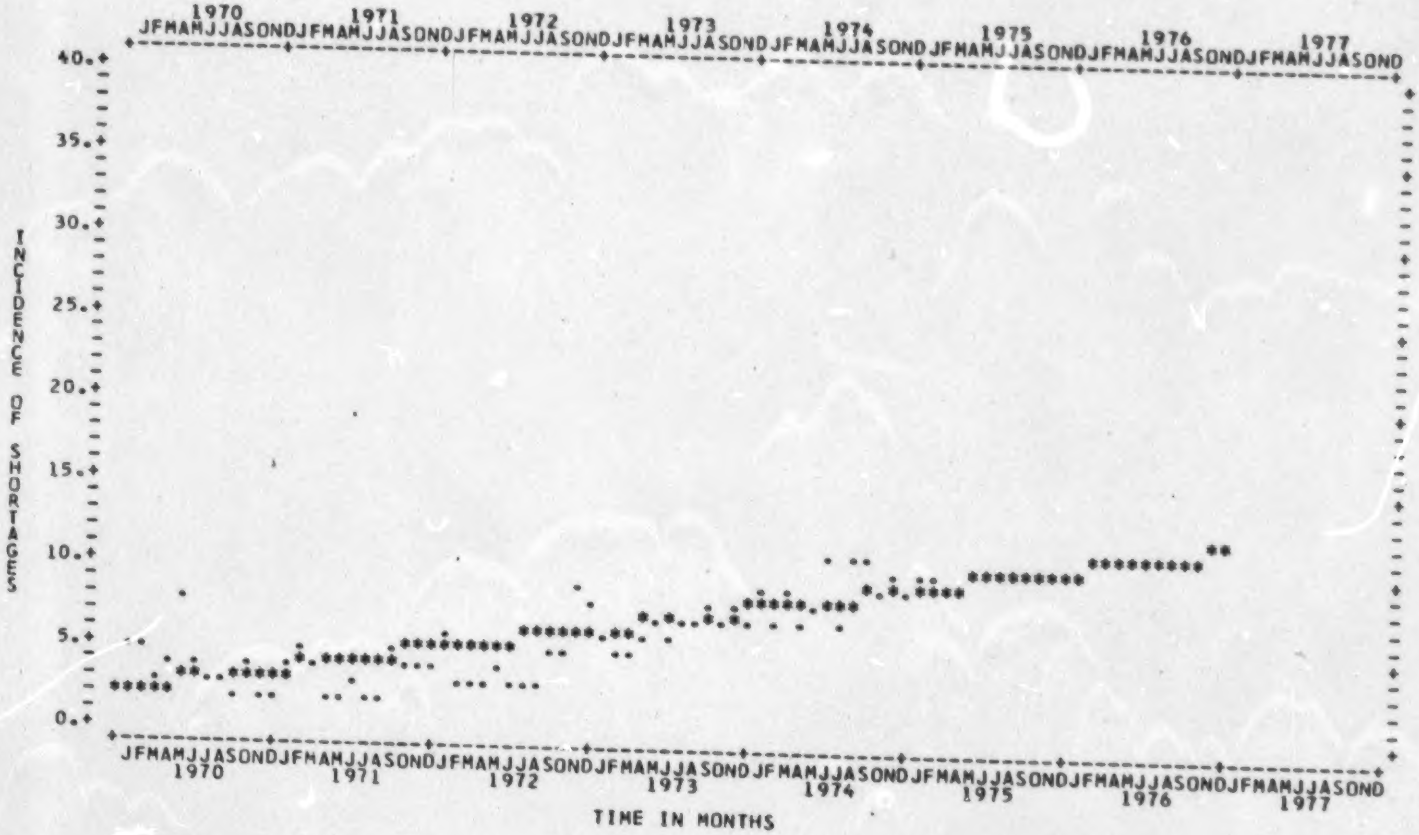
```
LEAST SQUARES TREND LINE     Y      =   0.7598 * (X) + 10.5352          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION   R      =   0.8251                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE   S(Y.X)=    9.3
STANDARD DEVIATION OF Y      S(Y)   =  16.5
COVARIANCE OF X AND Y        S(XY) = 243.3
```

MECHANICAL TECHNOLOGY/MACHINE SHOP OPERATIONS (CLASSIFIED WANT-ADS DATA07/25/75



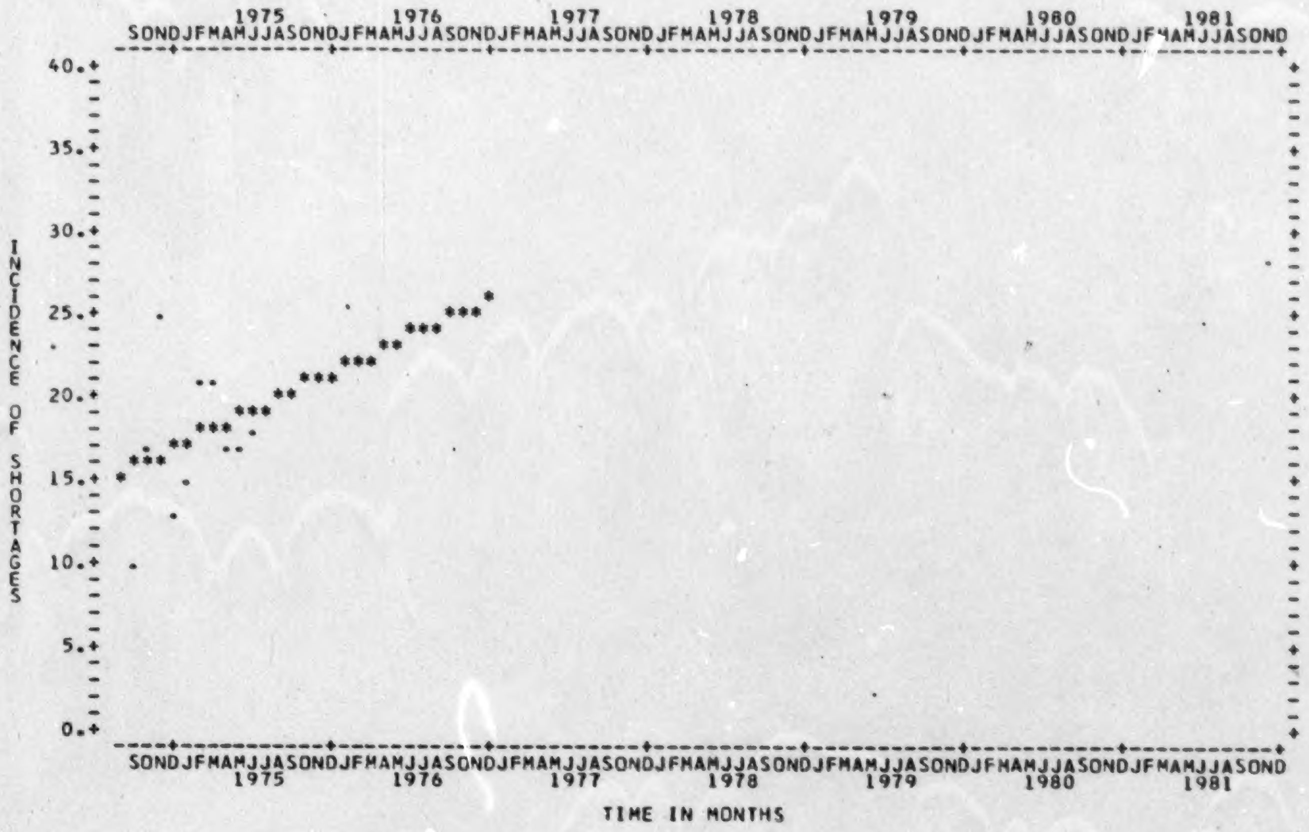
```
LEAST SQUARES TREND LINE        Y      =   2.7758 * (X) + 78.1333          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION      R      =   0.5965                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE      S(Y.X)=  10.7
STANDARD DEVIATION OF Y         S(Y)   =  13.4
COVARIANCE OF X AND Y           S(XY)  =  22.9
```

NUCLEAR SYSTEMS TECHNOLOGY (TEC DATA)   06/12/75



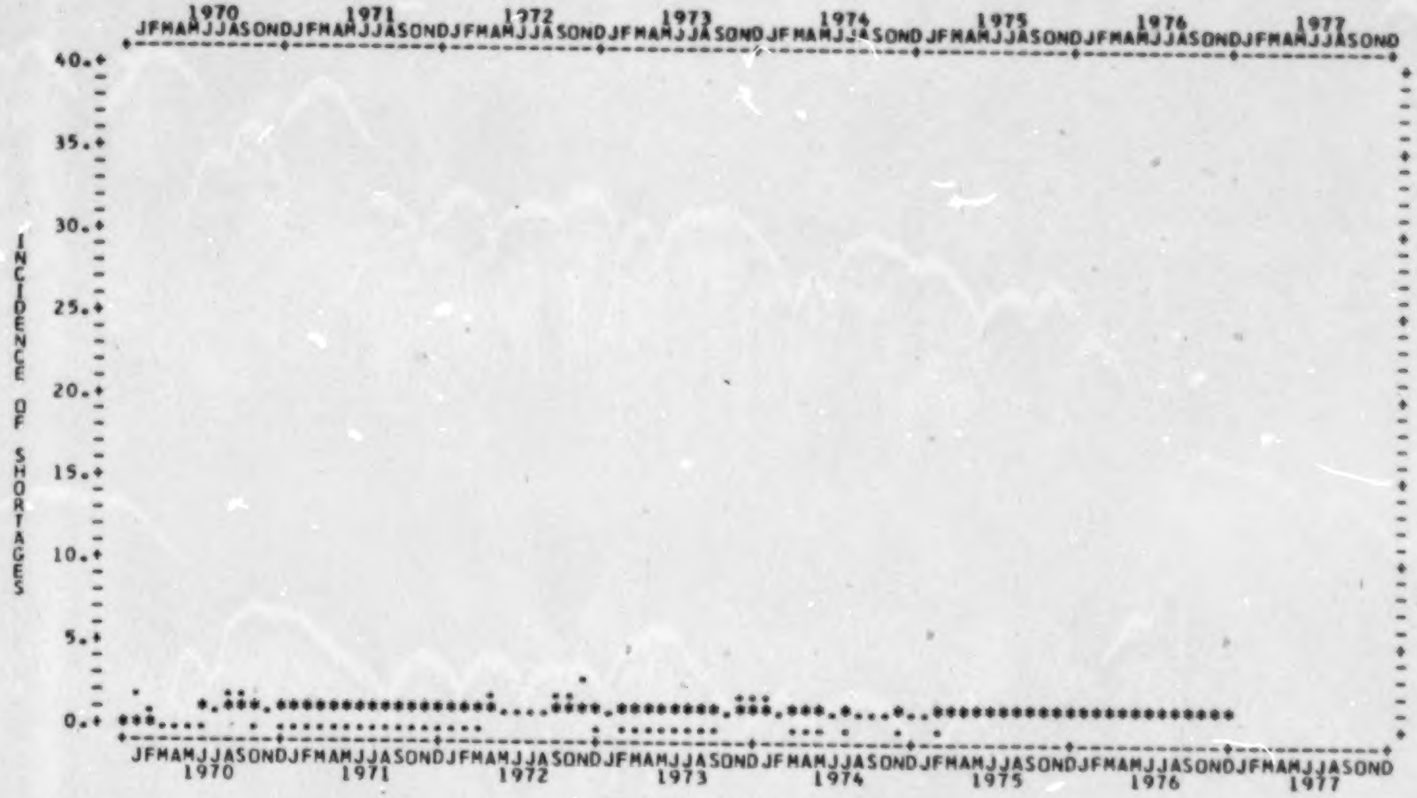
```
LEAST SQUARES TREND LINE        Y      =    0.1153 * (X) +  1.9498
COEFFICIENT OF CORRELATION      R      =    0.7877                         . = HISTORY OF DATA
STANDARD ERROR OF ESTIMATE      S(Y.X)=     1.6                            * = CALCULATED DATA
STANDARD DEVIATION OF Y         S(Y)   =    2.6
COVARIANCE OF X AND Y           S(XY)  =   37.2
```

```
NUCLEAR SYSTEMS TECHNOLOGY (CLASSIFIED WANT-ADS DATA)           07/25/75
```



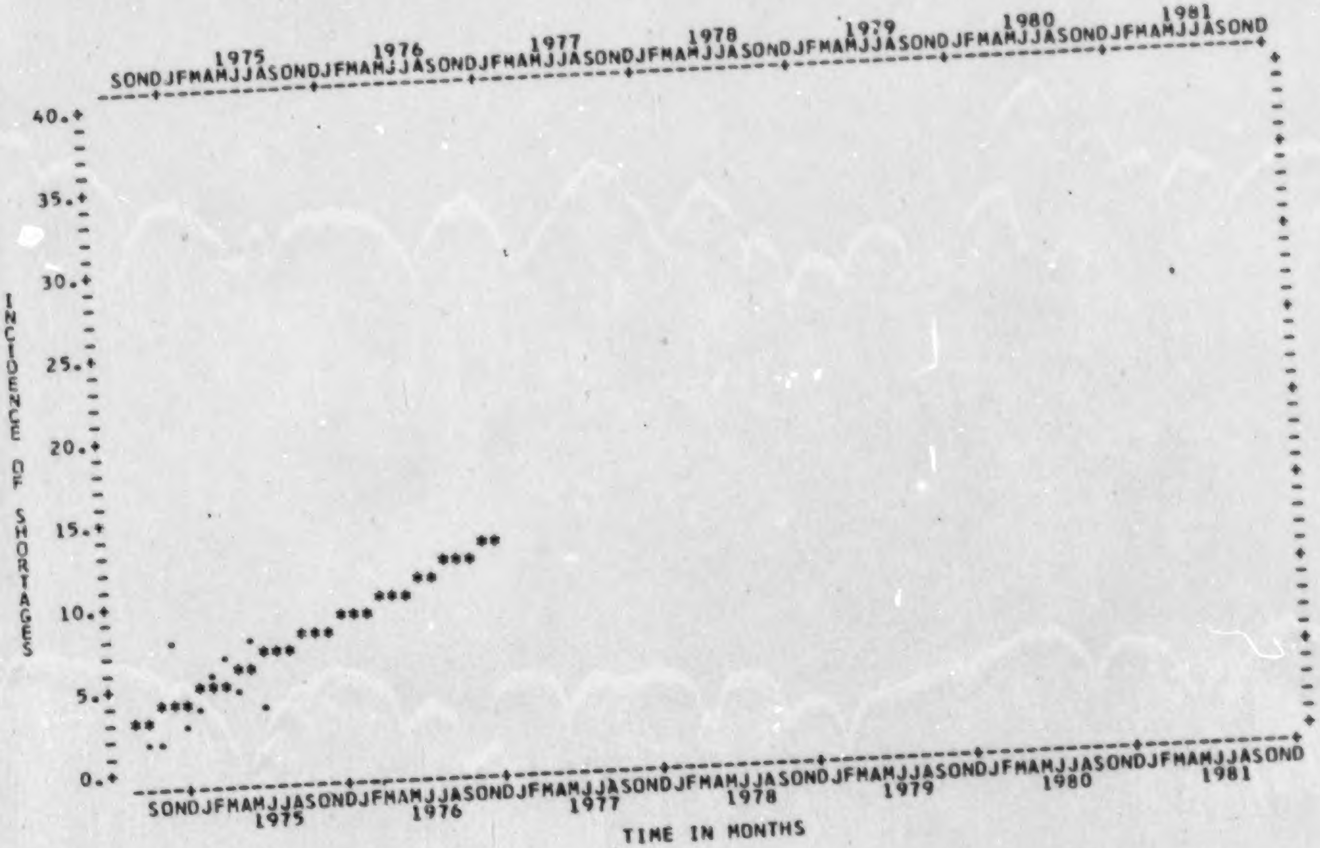
```
LEAST SQUARES TREND LINE      Y      =   0.3758 * (X) + 15.3333          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.2662                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    3.9
STANDARD DEVIATION OF Y       S(Y)   =   4.1
COVARIANCE OF X AND Y         S(XY)_=    3.1
```

```
                    OCCUPATIONAL SAFETY & HEALTH (TEC DATA)                06/12/75
```



```
LEAST SQUARES TRE'D LINE       Y       =    0.0038 * (X) +  0.4786        :  = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R       =    0.0847                        *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=      0.8
STANDARD DEVIATION OF Y        S(Y)  =      0.8
COVARIANCE OF X AND Y          S(XY) =      1.2
```

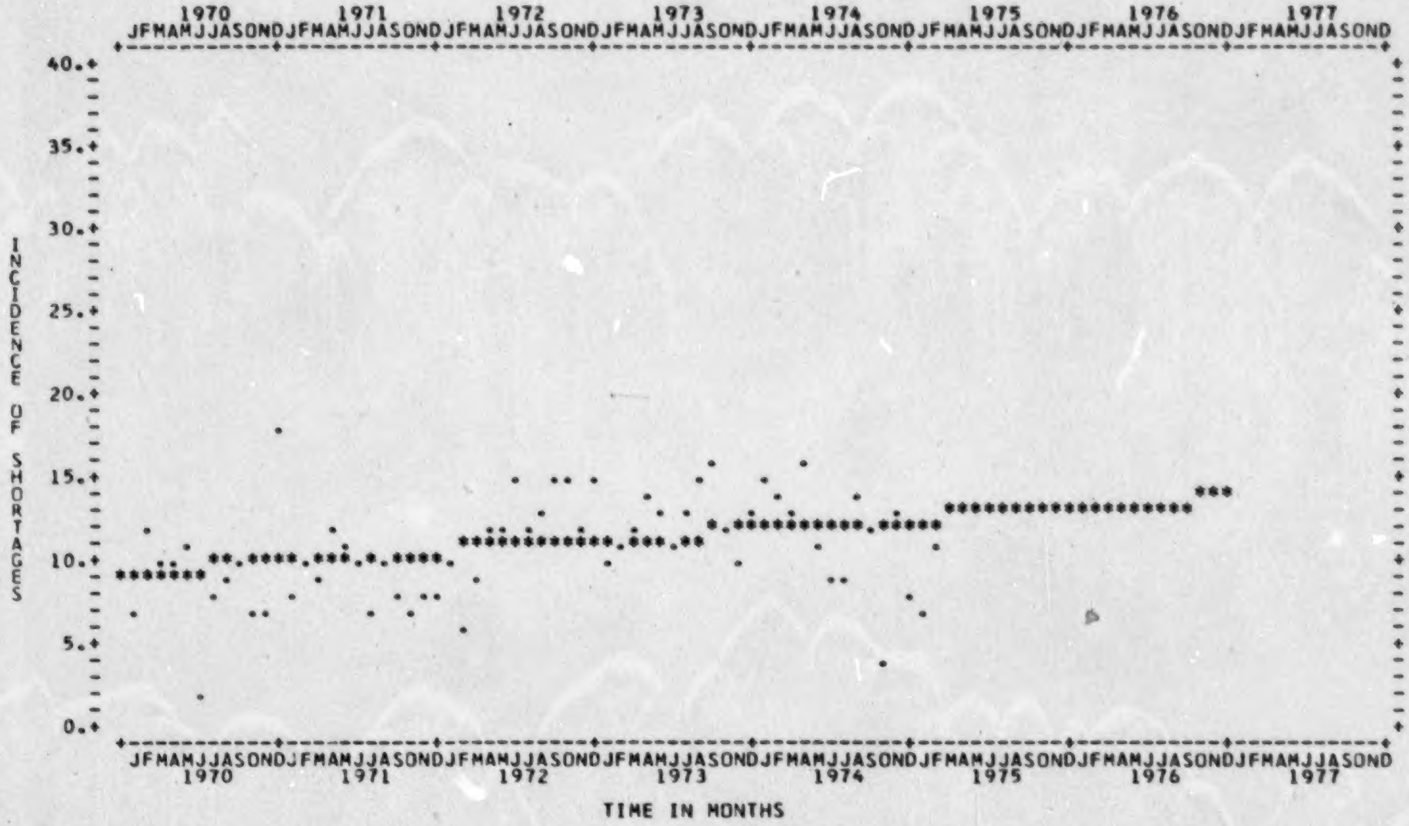
OCCUPATIONAL SAFETY & HEALTH CLUSTER (CLASSIFIED WANT-ADS DATA)   07/25/75



```
LEAST SQUARES TREND LINE       Y      =   0.3576 * (X) +  2.9333
COEFFICIENT OF CORRELATION     R      =   0.4743
STANDARD ERROR OF ESTIMATE     S(Y.X) =   1.9
STANDARD DEVIATION OF Y        S(Y)   =   2.2
COVARIANCE OF X AND Y          S(XY)  =   2.9
```

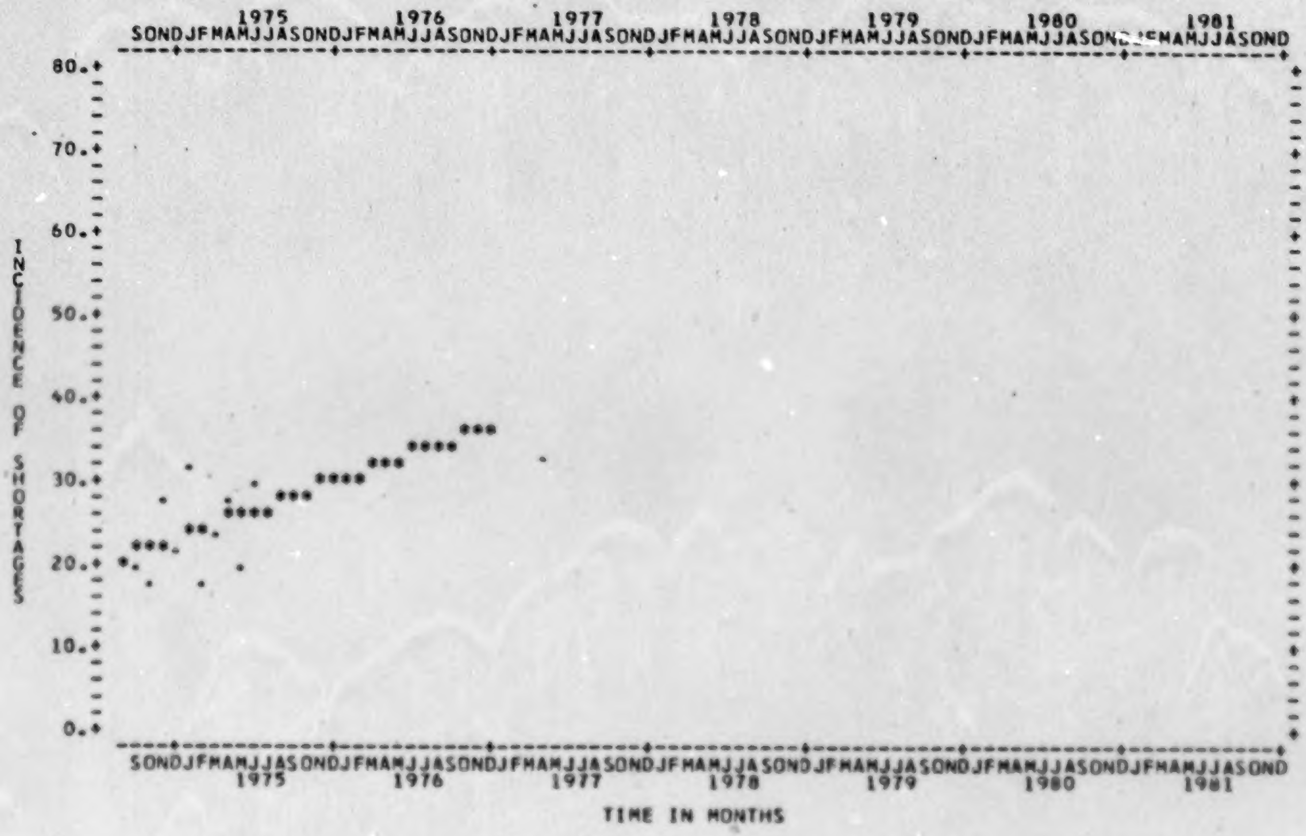
. = HISTORY OF DATA
* = CALCULATED DATA

RADIO & TELEVISION SERVICING (TEC DATA) 06/12/75



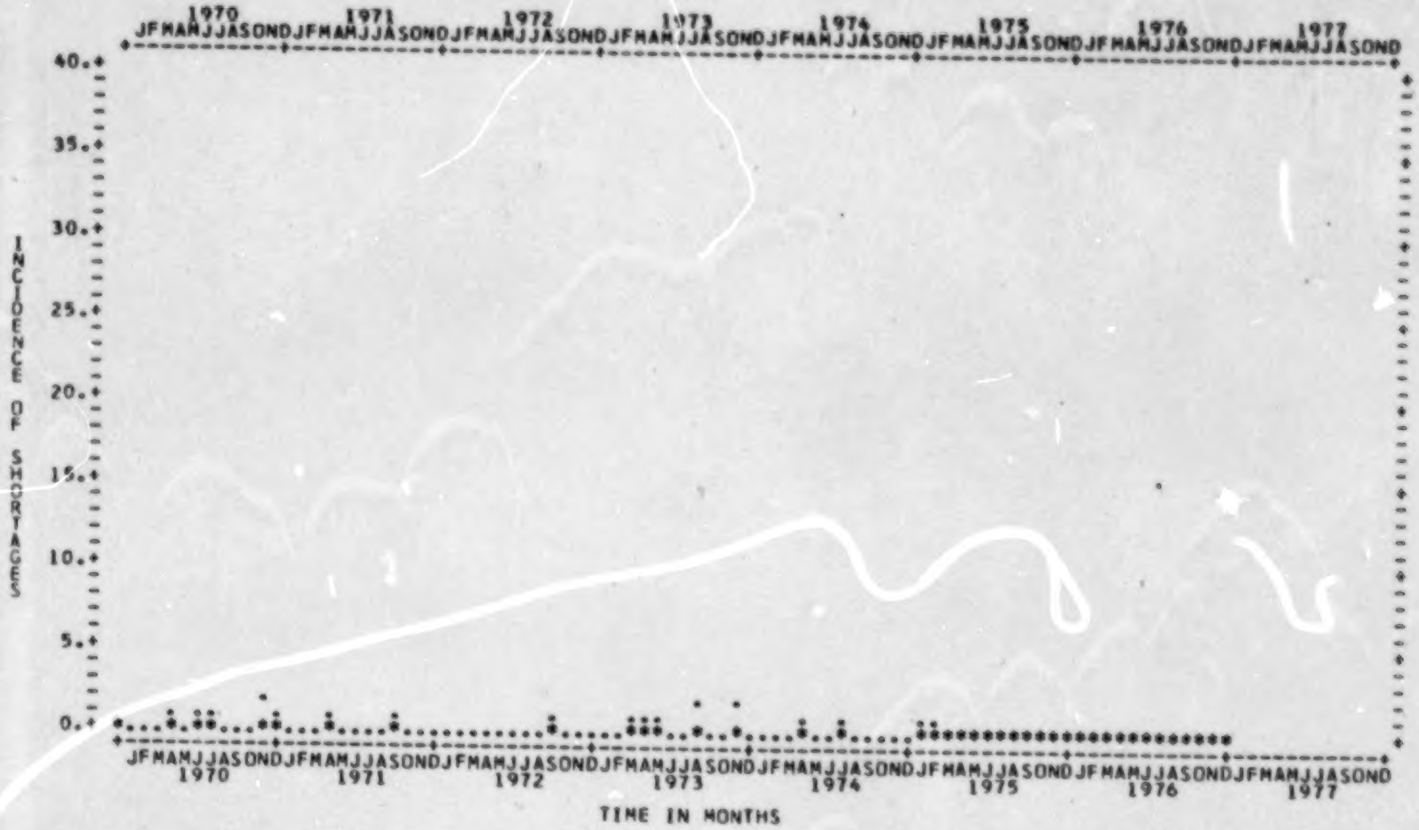
```
LEAST SQUARES TREND LINE      Y      =  0.0536 * (X) +  9.1354            . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =  0.3115                            * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=   2.9
STANDARD DEVIATION OF Y       S(Y)   =  3.1
COVARIANCE OF X AND Y         S(XY)  =  17.2
```

```
RADIO & TELEVISION SERVICING (CLASSIFIED WANT-ADS DATA)          07/25/75
```



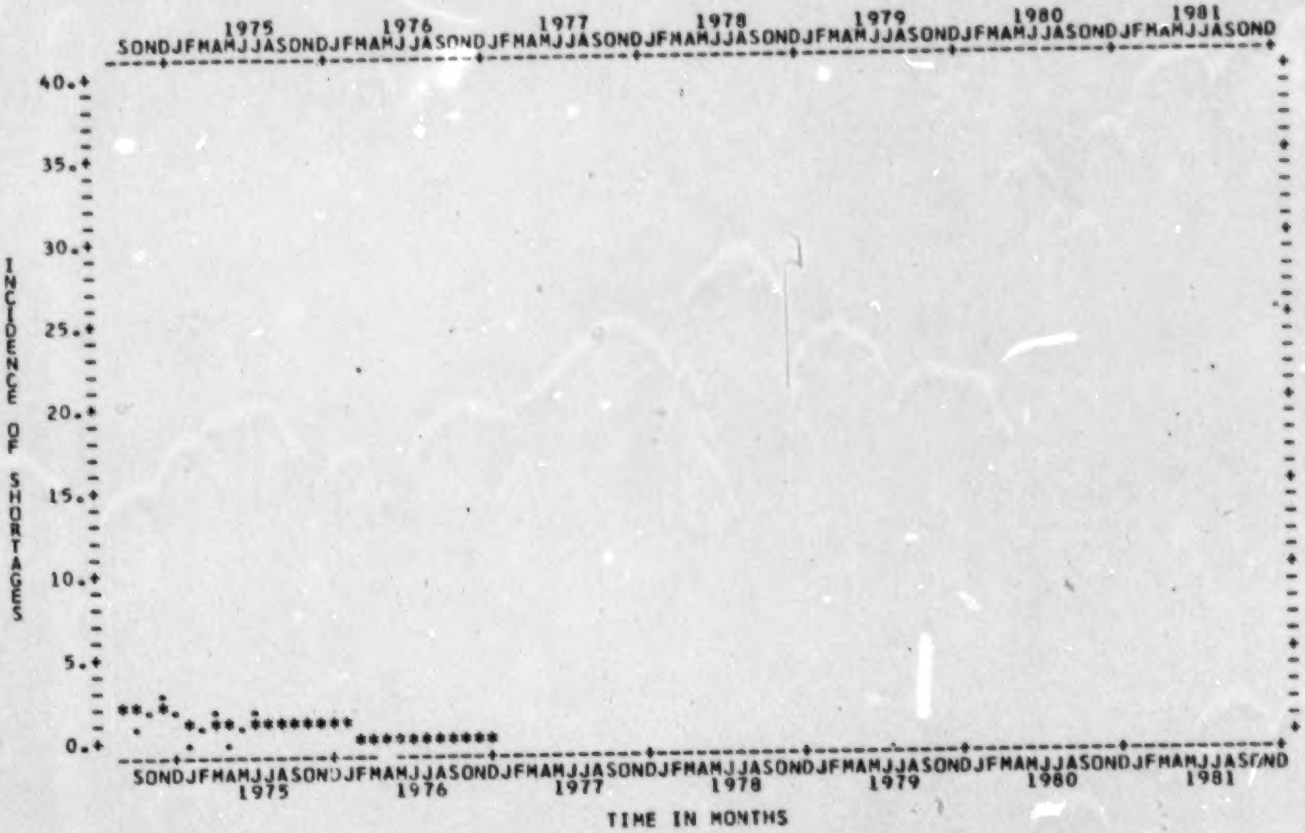
```
LEAST SQUARES TREND LINE      Y      =   0.5758 * (X) + 20.5333          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.3478                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    4.5
STANDARD DEVIATION OF Y       S(Y)   =   4.8
COVARIANCE OF X AND Y         S(XY)_=    4.7
```

RECREATION SUPERVISION CLUSTER (TEC DATA)   06/05/75



```
LEAST SQUARES TREND LINE        Y      =   0.0012 * (X) +  0.2861        . = HISTORY OF DATA
COEFFICIENT OF CORRELATION      R      =   0.0369                        * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE      S(Y.X) =   0.6
STANDARD DEVIATION OF Y         S(Y)   =   0.6
COVARIANCE OF X AND Y           S(XY)  =   0.4
```

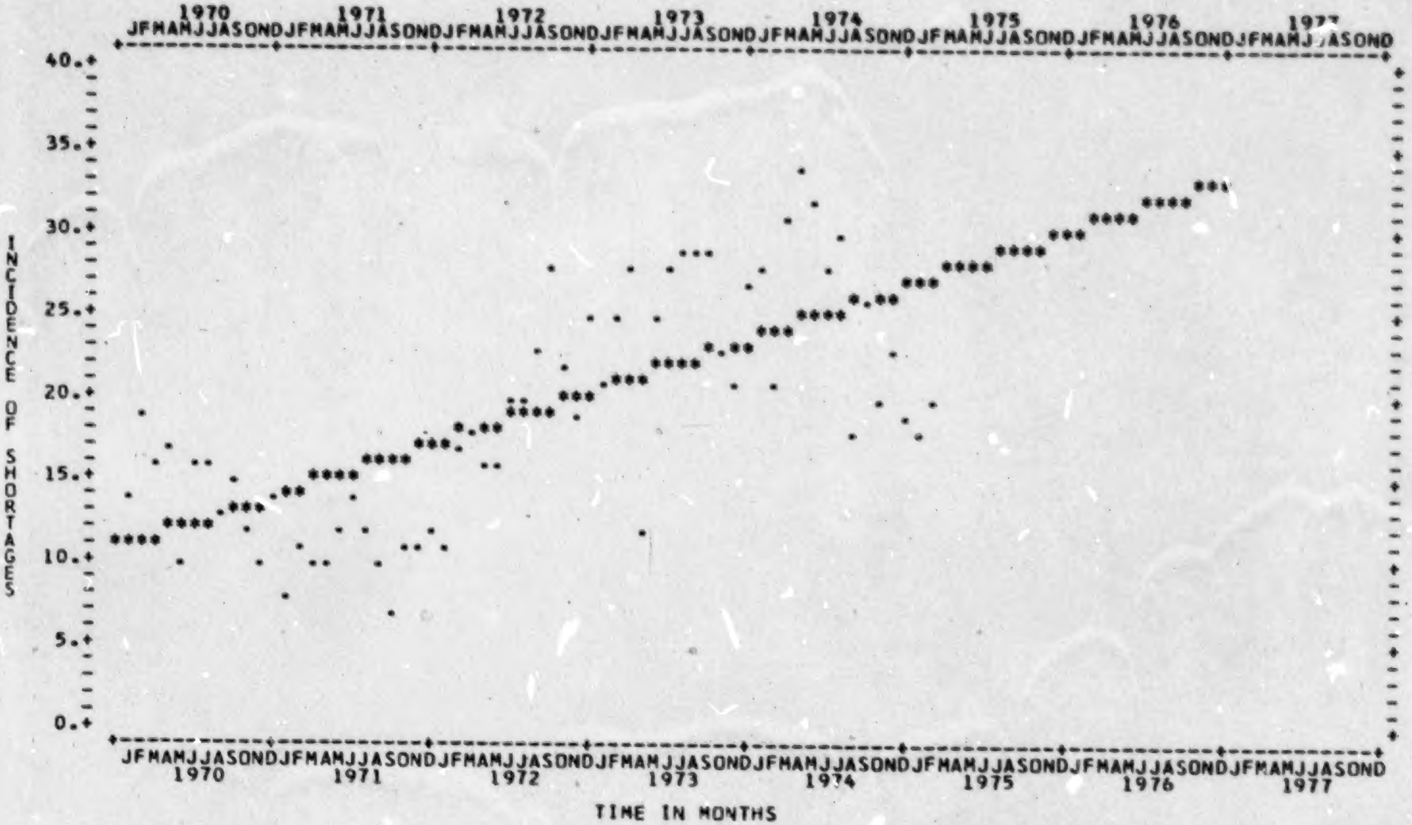
RECREATION SUPERVISION CLUSTER (CLASSIFIED WANT-ADS DATA)   07/25/75



```
LEAST SQUARES TREND LINE     Y      =  -0.0727 * (X) +  1.8000
COEFFICIENT OF CORRELATION   R      =  -0.2279
STANDARD ERROR OF ESTIMATE   S(Y.X)=    0.9
STANDARD DEVIATION OF Y      S(Y)   =   0.9
COVARIANCE OF X AND Y        S(XY)  =  -0.6
```

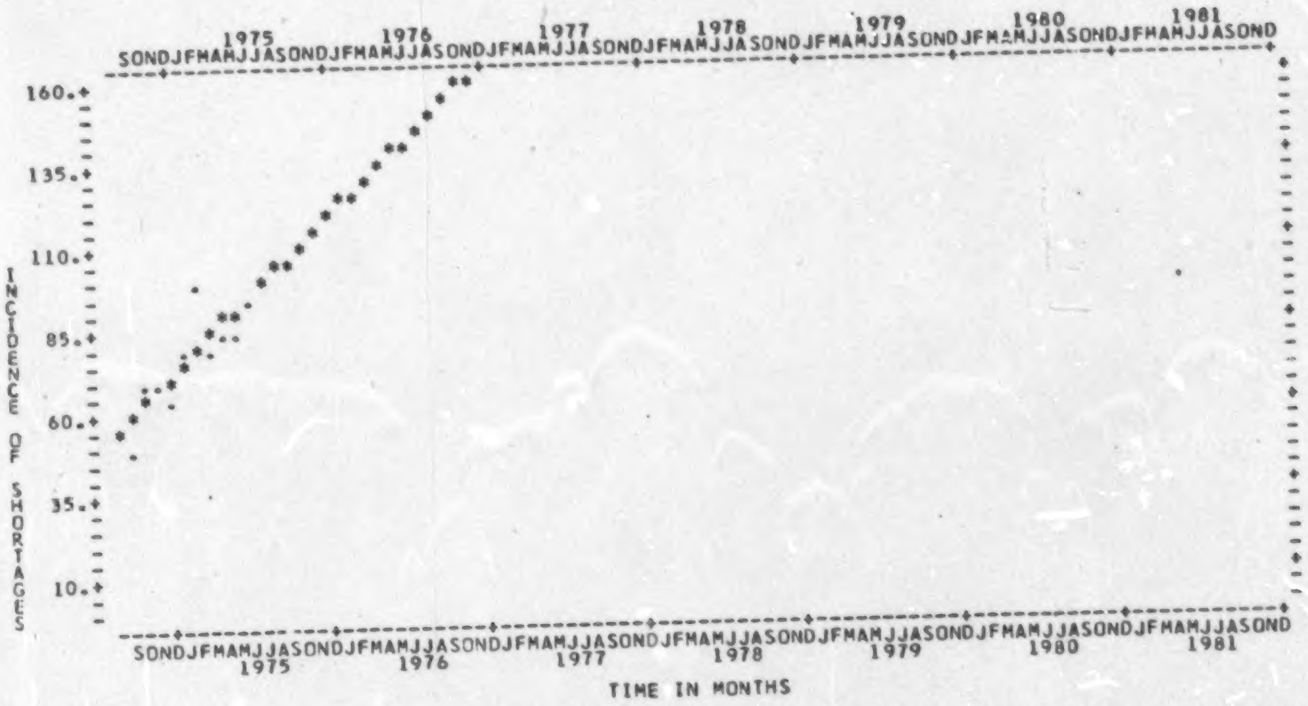
. = HISTORY OF DATA
* = CALCULATED DATA

```
SEED & GRAIN TECHNOLOGY (TEC DATA)                    06/10/75
```



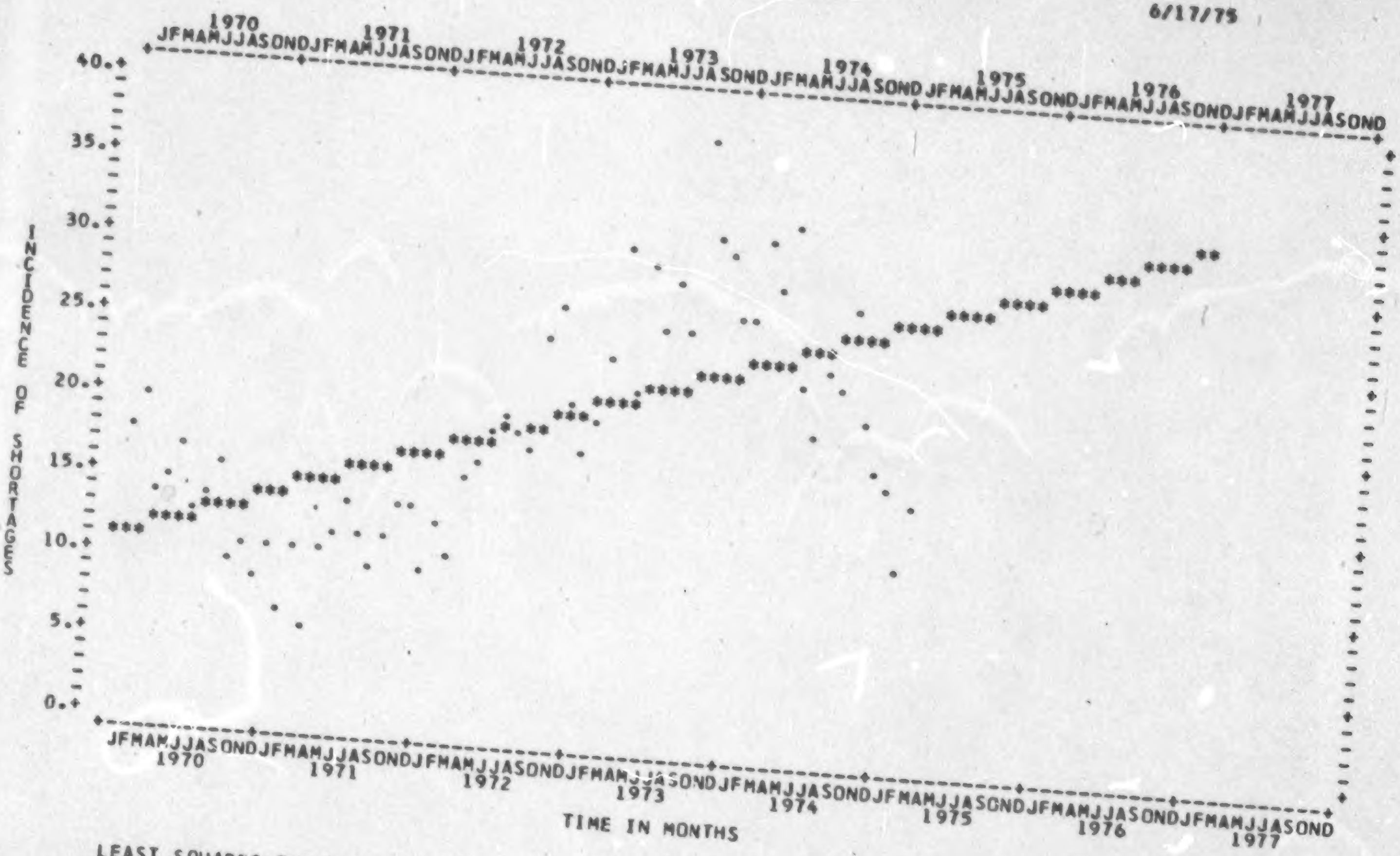
```
LEAST SQUARES TREND LINE      Y      =   0.2703 * (X) + 10.5193      :  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.6939                      *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    5.0
STANDARD DEVIATION OF Y       S(Y)   =   7.0
COVARIANCE OF X AND Y         S(XY)  =   86.5
```

SEED & GRAIN TECHNOLOGY (CLASSIFIED WANT-ADS DATA)   07/30/75



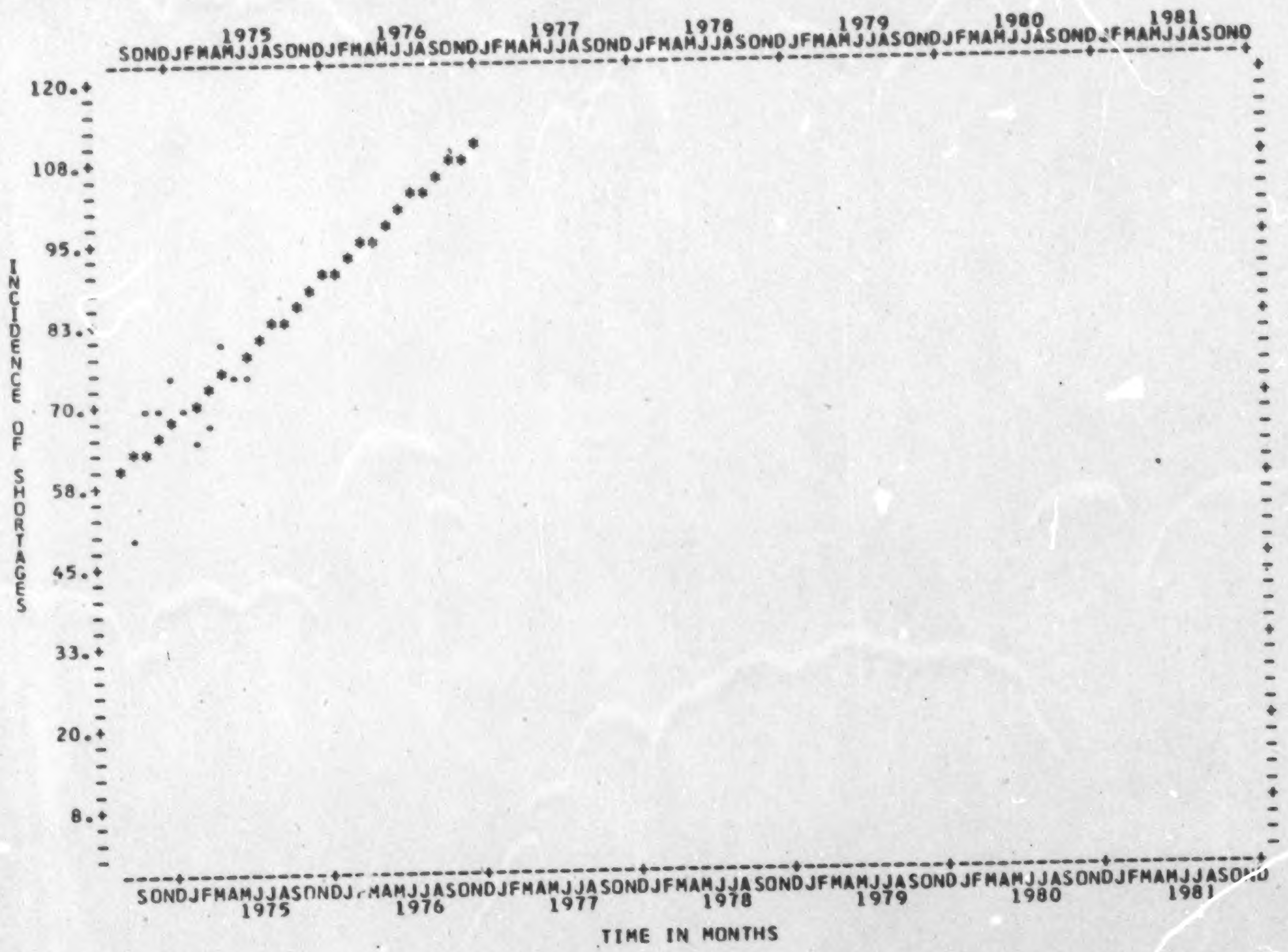
```
LEAST SQUARES TREND LINE      Y      =    3.9091 * (X) + 56.4000          : = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =    0.8127                           * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=     8.1
STANDARD DEVIATION OF Y       S(Y)   =    13.8
COVARIANCE OF X AND Y         S(XY)  =    32.3
```

```
SPECIAL PROGRAMS MDTA (TEC DATA)

                                                                    6/17/75
```



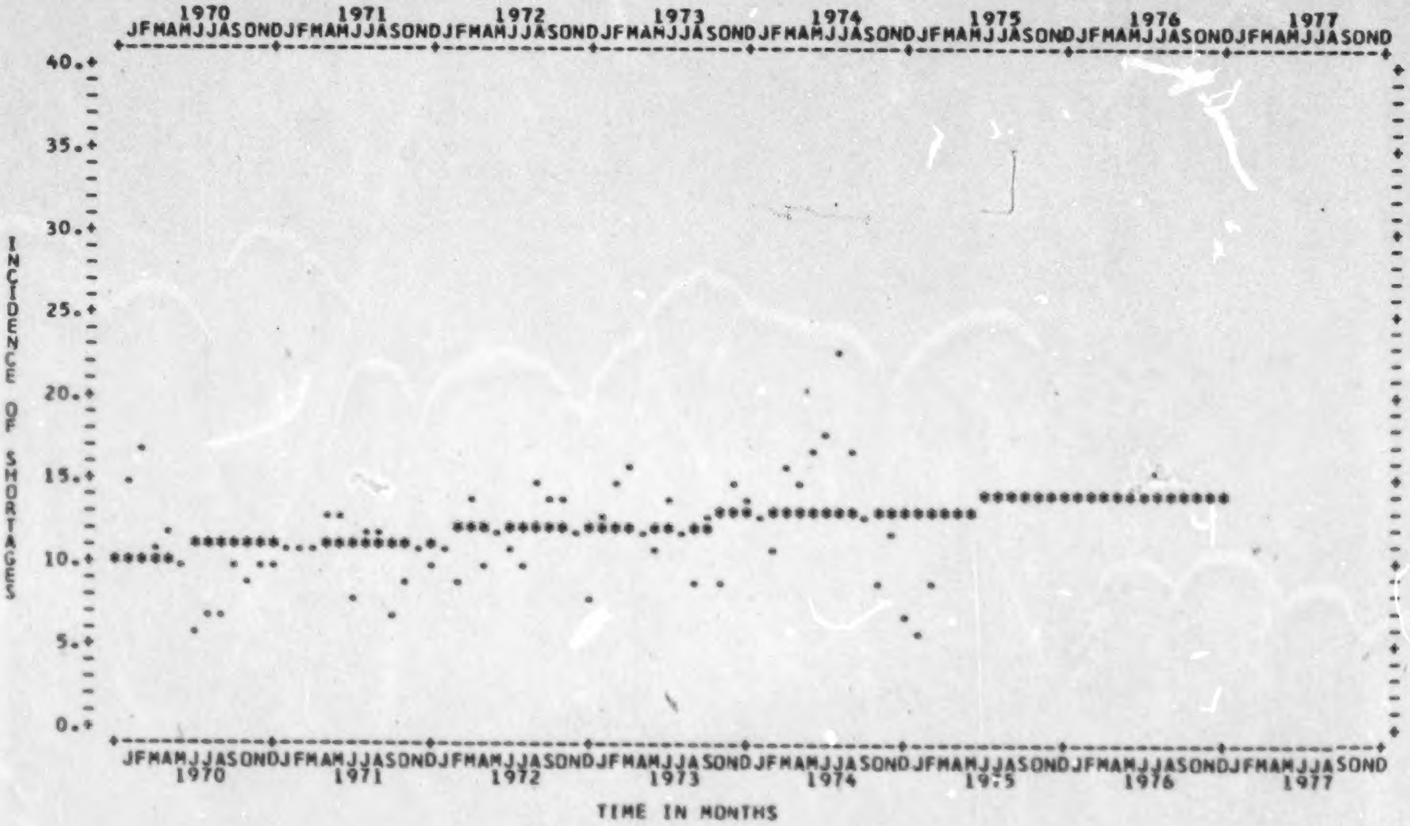
```
LEAST SQUARES TREND LINE          Y      =    0.2617 * (X) + 10.8535
COEFFICIENT OF CORRELATION        R      =    0.6286
STANDARD ERROR OF ESTIMATE        S(Y,X)=     5.8
STANDARD DEVIATION OF Y           S(Y)   =    7.5
COVARIANCE OF X AND Y             S(XY)  =    83.8

                                                                    . = HISTORY OF DATA
                                                                    * = CALCULATED DATA
```

SPECIAL PROGRAMS MDTA (CLASSIFIED WANT-ADS DATA) 07/30/75



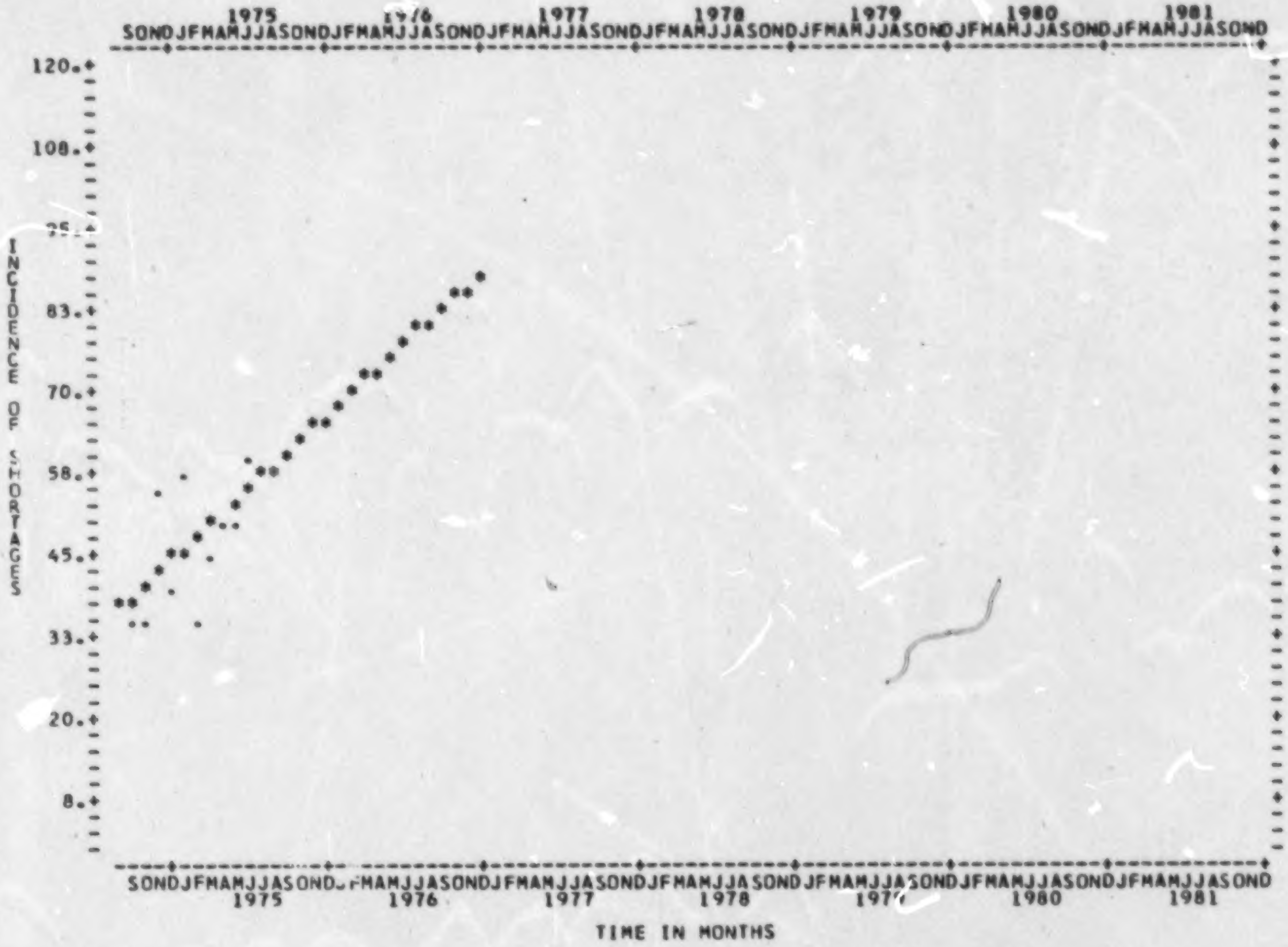
```
LEAST SQUARES TREND LINE        Y      =   1.8000 * (X) + 60.0000        :  = HISTORY OF DATA
COEFFICIENT OF CORRELATION      R      =   0.6[illegible]                *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE      S(Y.X)=    6.1
STANDARD DEVIATION OF Y         S(Y)   =   8.0
COVARIANCE OF X AND Y           S(XY)  =   14.8
```

```
                         SUPERMARKET MANAGEMENT (TEC DATA)                         06/12/75
```



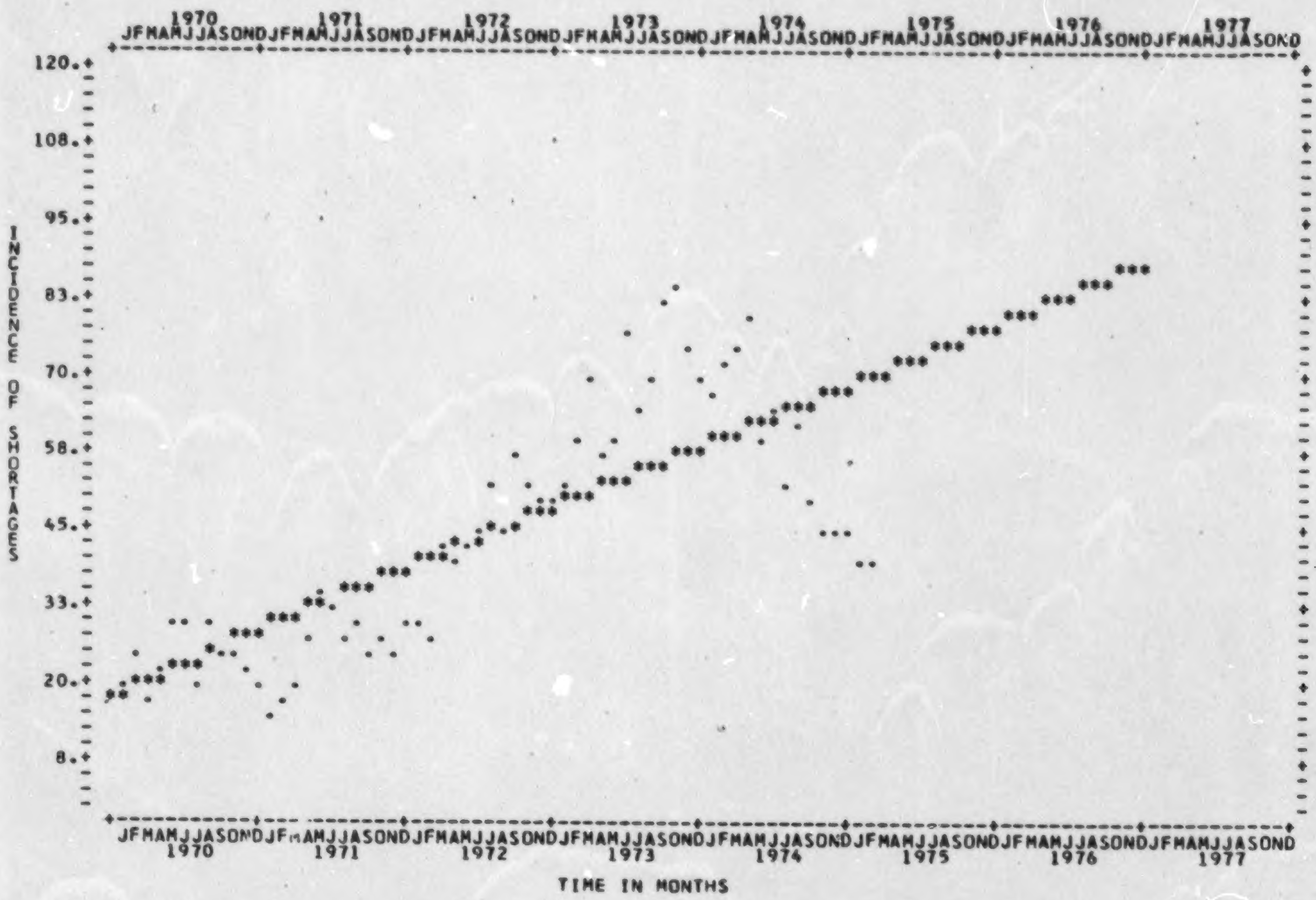
```
LEAST SQUARES TREND LINE      Y      =   0.0502 * (X) + 10.2094          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.2804                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    3.1
STANDARD DEVIATION OF Y       S(Y)   =   3.2
COVARIANCE OF X AND Y         S(XY)  =   [illegible]
```

SUPERMARKET MANAGEMENT (CLASSIFIED WANT-ADS DATA)   07/30/75



```
LEAST SQUARES TREND LINE       Y      =   1.8424 * (X) + 36.4667          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R      =   0.5705                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y,X)=    7.6
STANDARD DEVIATION OF Y        S(Y)   =   9.3
COVARIANCE OF X AND Y          S(XY)  =  15.2
```

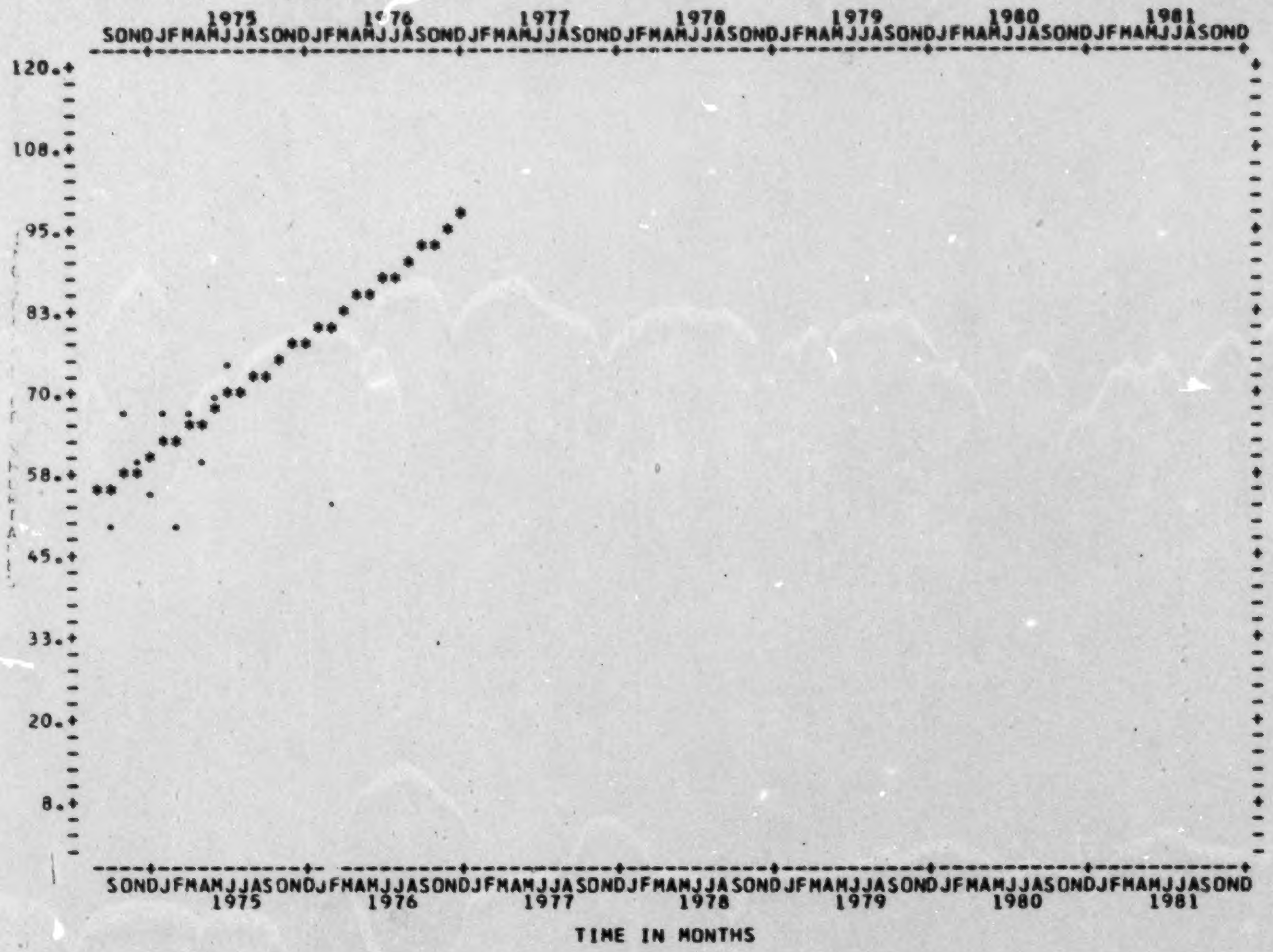
SUPPORTIVE SERVICES CLUSTER (TEC DATA)   06/06/75



```
LEAST SQUARES TREND LINE      Y       =   0.8435 * (X) + 17.8170
COEFFICIENT OF CORRELATION    R       =   0.7711
STANDARD ERROR OF ESTIMATE    S(Y.X)=   12.5
STANDARD DEVIATION OF Y       S(Y)    =   19.6
COVARIANCE OF X AND Y         S(XY) = 270.1
```

. = HISTORY OF DATA
* = CALCULATED DATA

SUPPORTIVE SERVICES CLUSTER (CLASSIFIED WANT-ADS DATA)   07/30/75



```
LEAST SQUARES TREND LINE       Y      =   1.5091 * (X) + 54.0000          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R      =   0.5487                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=    6.6
STANDARD DEVIATION OF Y        S(Y)   =   7.9
COVARIANCE OF X AND Y          S(XY)  =  12.4
```

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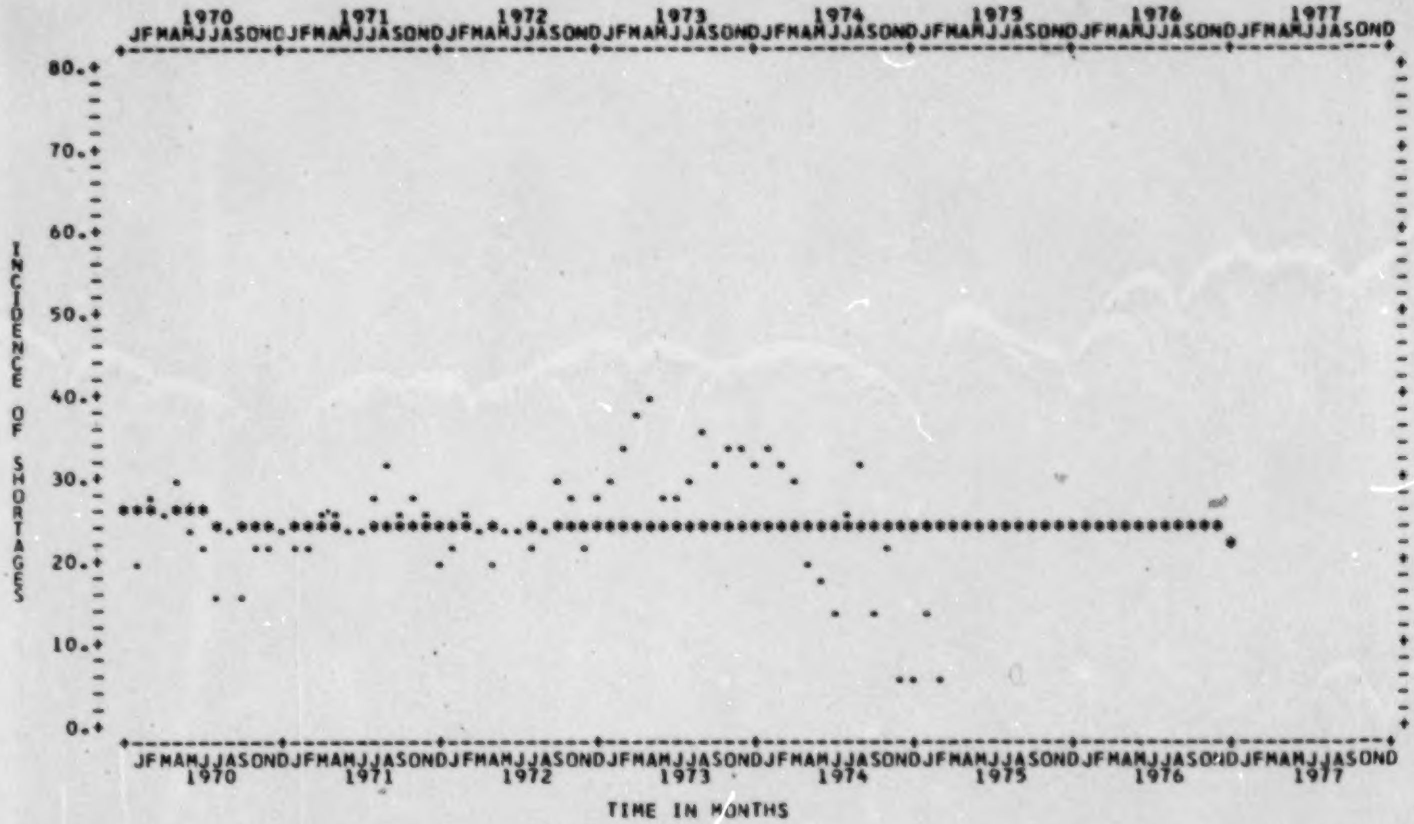
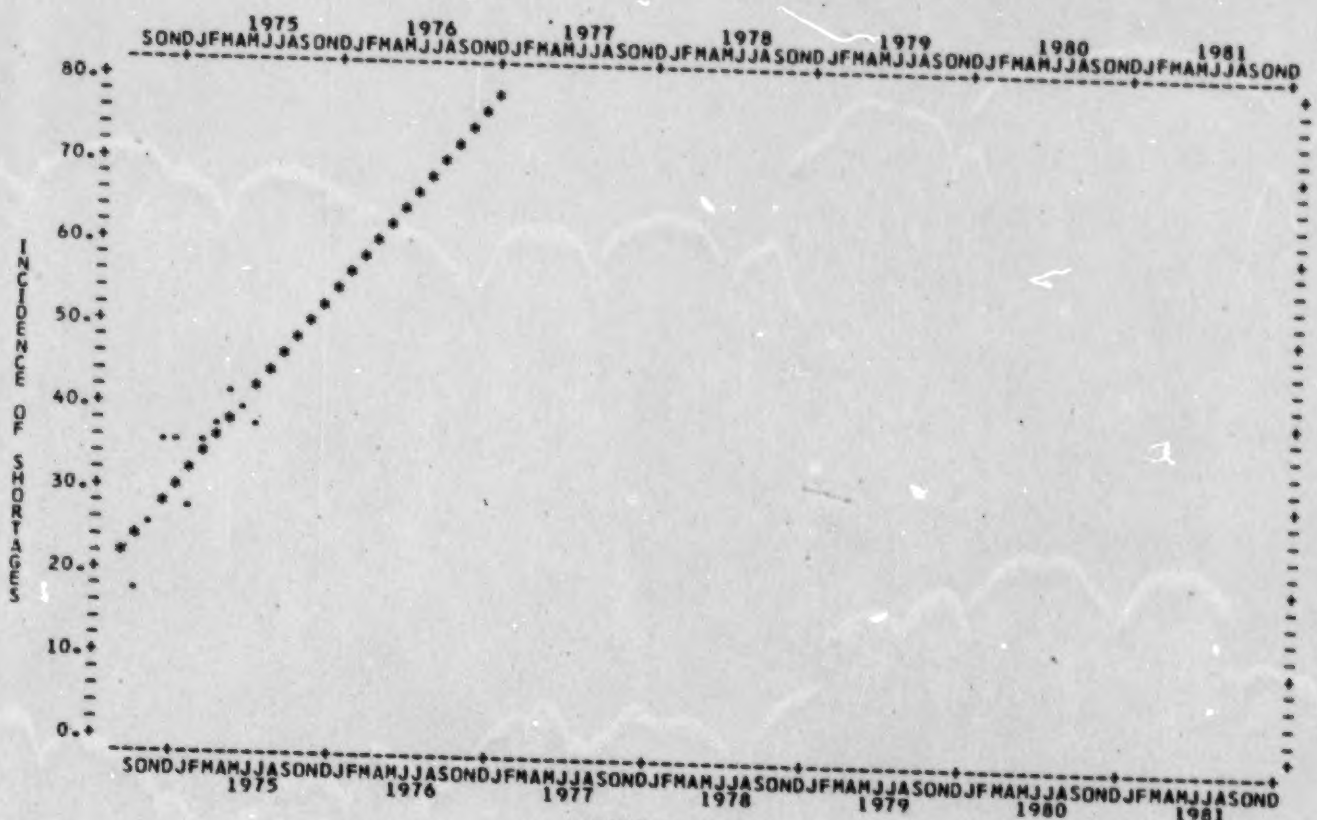
TECHNICAL DEVELOPMENT CLUSTER (TEC DATA) 06/05/75



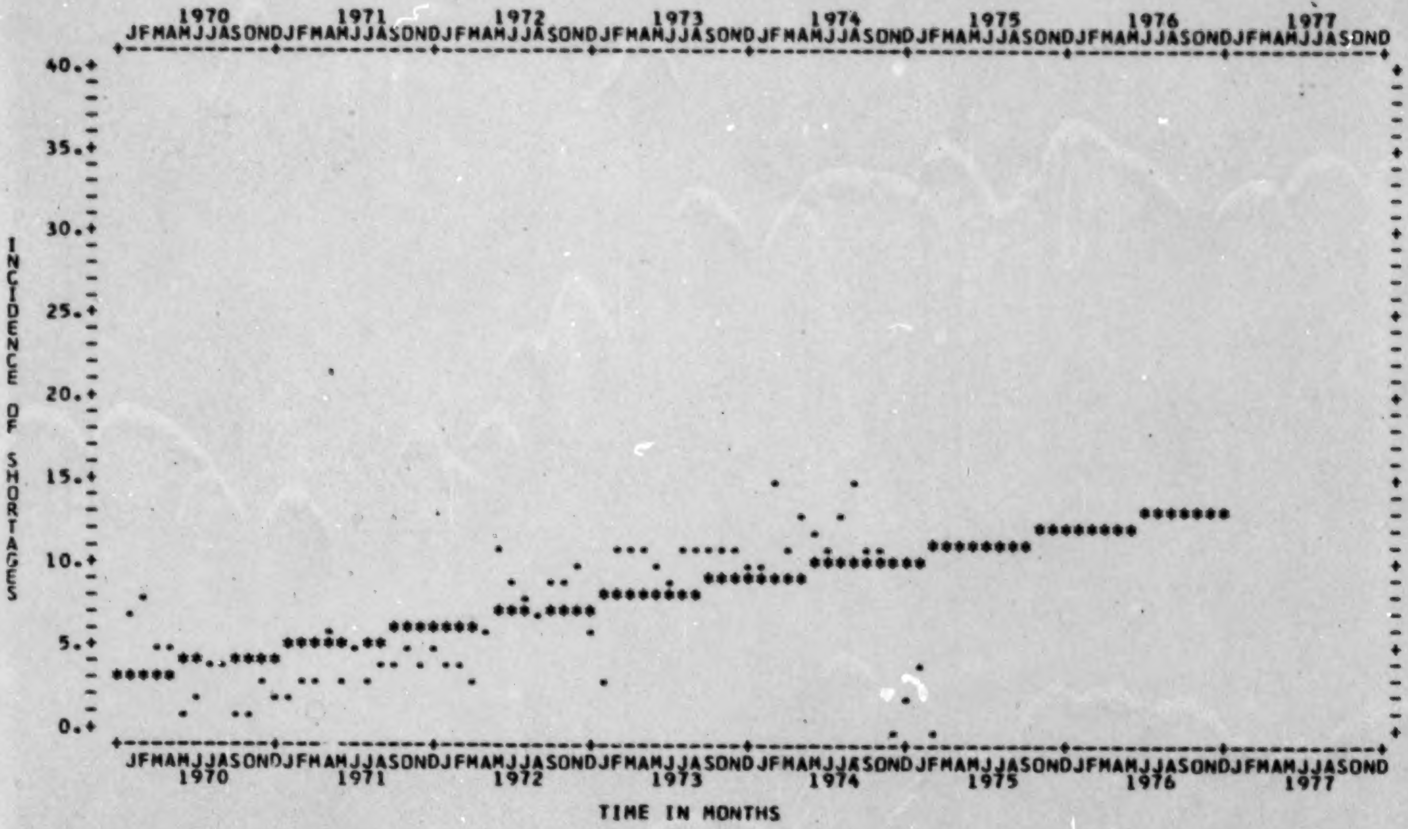
```
LEAST SQUARES TREND LINE      Y      =  -0.0259 * (X) + 25.1719       .  = HISTORY OF DATA
COEFFICIENT OF  ORRELATION    R      =  -0.0652                       *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    7.1
STANDARD DEVIATION OF Y       S(Y)   =   7.1
COVARIANCE OF X AND Y         S(XY)  =  -8.3
```

TECHNICAL DEVELOPMENT CLUSTER (CLASSIFIED WANT-ADS DATA)   07/30/75



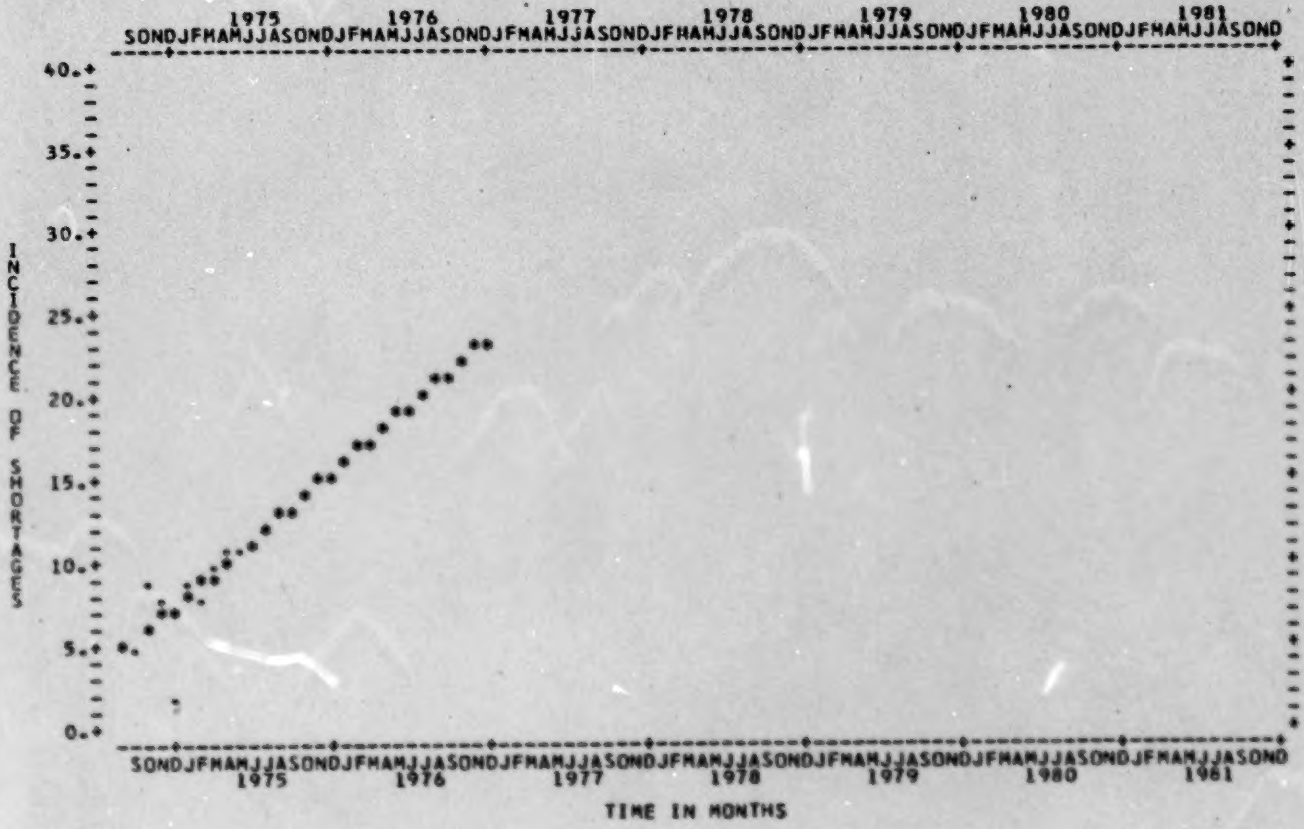
```
LEAST SQUARES TREND LINE          Y       =   1.9576 * (X) + 22.5333
COEFFICIENT OF CORRELATION        R       =   0.8115
STANDARD ERROR OF ESTIMATE        S(Y.X)=     4.0
STANDARD DEVIATION OF Y           S(Y)   =    6.9
COVARIANCE OF X AND Y             S(XY)  =   16.1

                                                          : = HISTORY OF DATA
                                                          * = CALCULATED DATA
```

TECHNICAL ILLUSTRATION (TEC DATA)   06/02/75



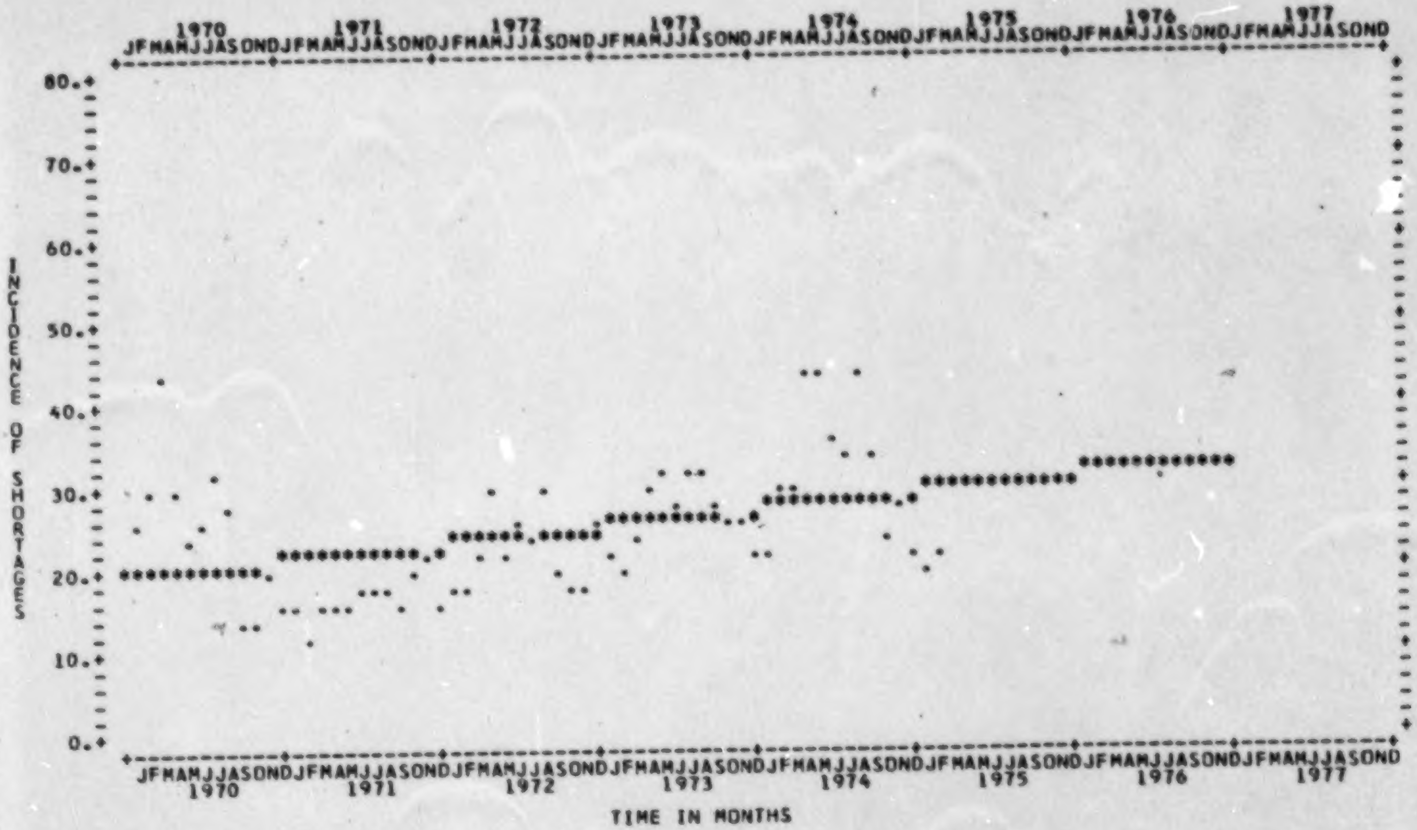
```
LEAST SQUARES TREND LINE       Y      =   0.1240 * (X) +  2.9313          .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION     R      =   0.5532                          *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE     S(Y.X)=    3.3
STANDARD DEVIATION OF Y        S(Y)   =   4.0
COVARIANCE OF X AND Y          S(XY)  =  39.7
```

TECHNICAL ILLUSTRATION CLUSTER (CLASSIFIED WANT-ADS DATA) 07/09/75



```
LEAST SQUARES TREND LINE      Y      =   0.6667 * (X) + 4.7778     * = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.6222                    + = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    2.2
STANDARD DEVIATION OF Y       S(Y)  =    2.8
COVARIANCE OF X AND Y         S(XY) =    4.4
```

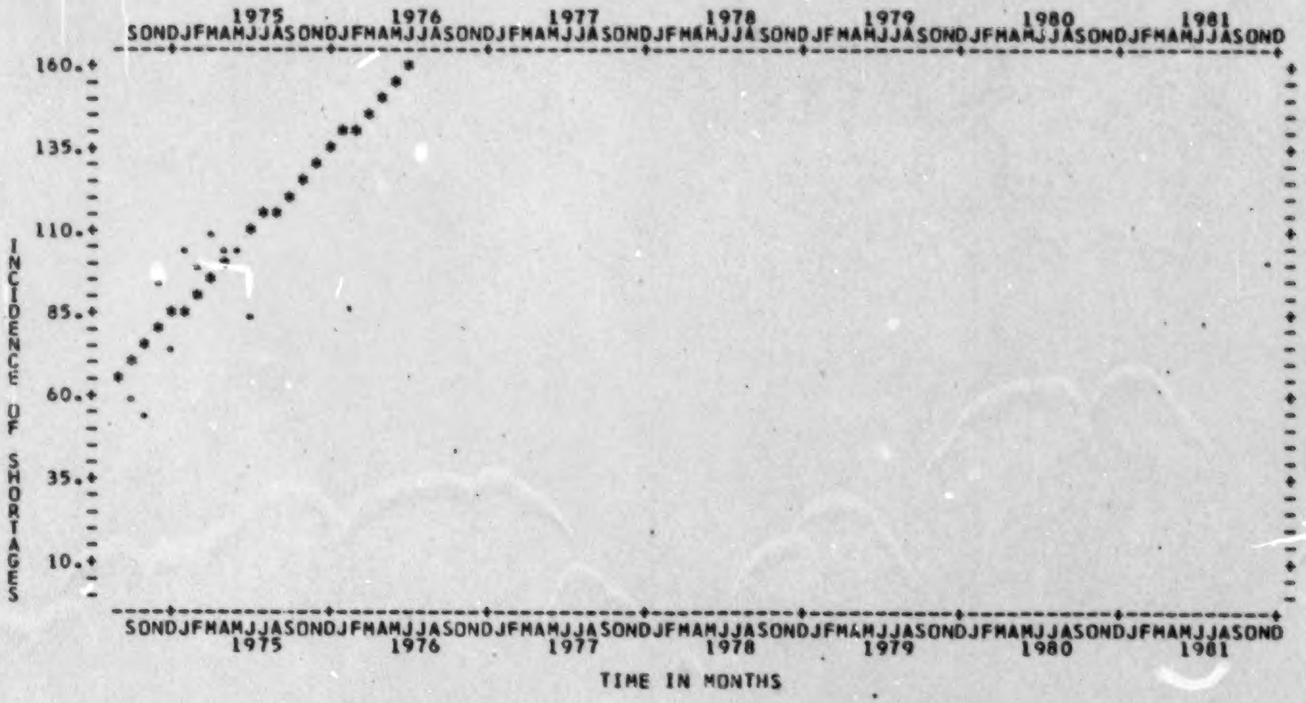
```
TECHNICAL WRITING CLUSTER (TEC DATA)                    06/04/75
```



```
LEAST SQUARES TREND LINE      Y      =   0.1640 * (X) + 19.0434          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.3771                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X) =   7.2
STANDARD DEVIATION OF Y       S(Y)   =   7.8
COVARIANCE OF X AND Y         S(XY)  =   52.5
```

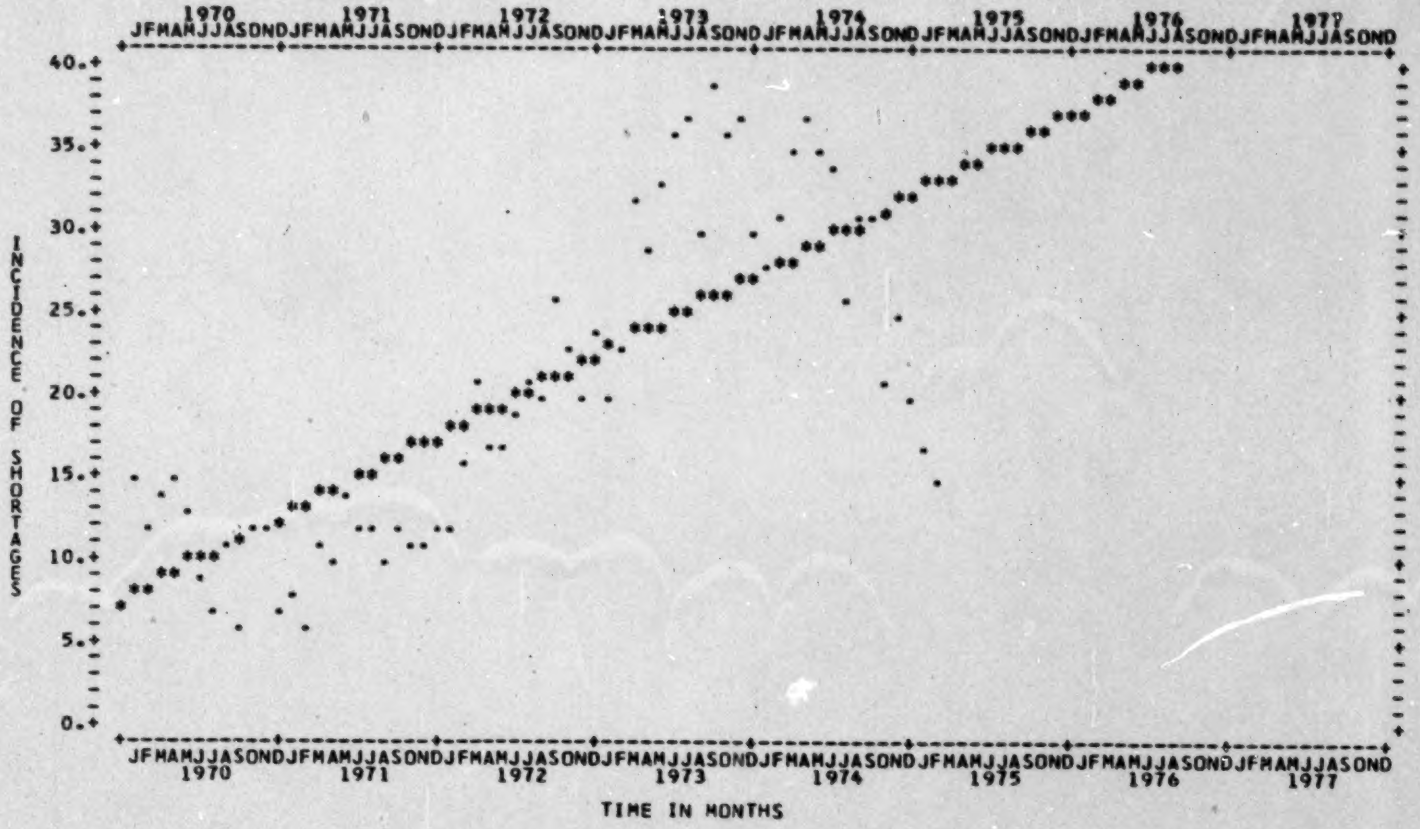
]

```
TECHNICAL WRITING CLUSTER (CLASSIFIED WANT-ADS DATA)        07/30/75
```



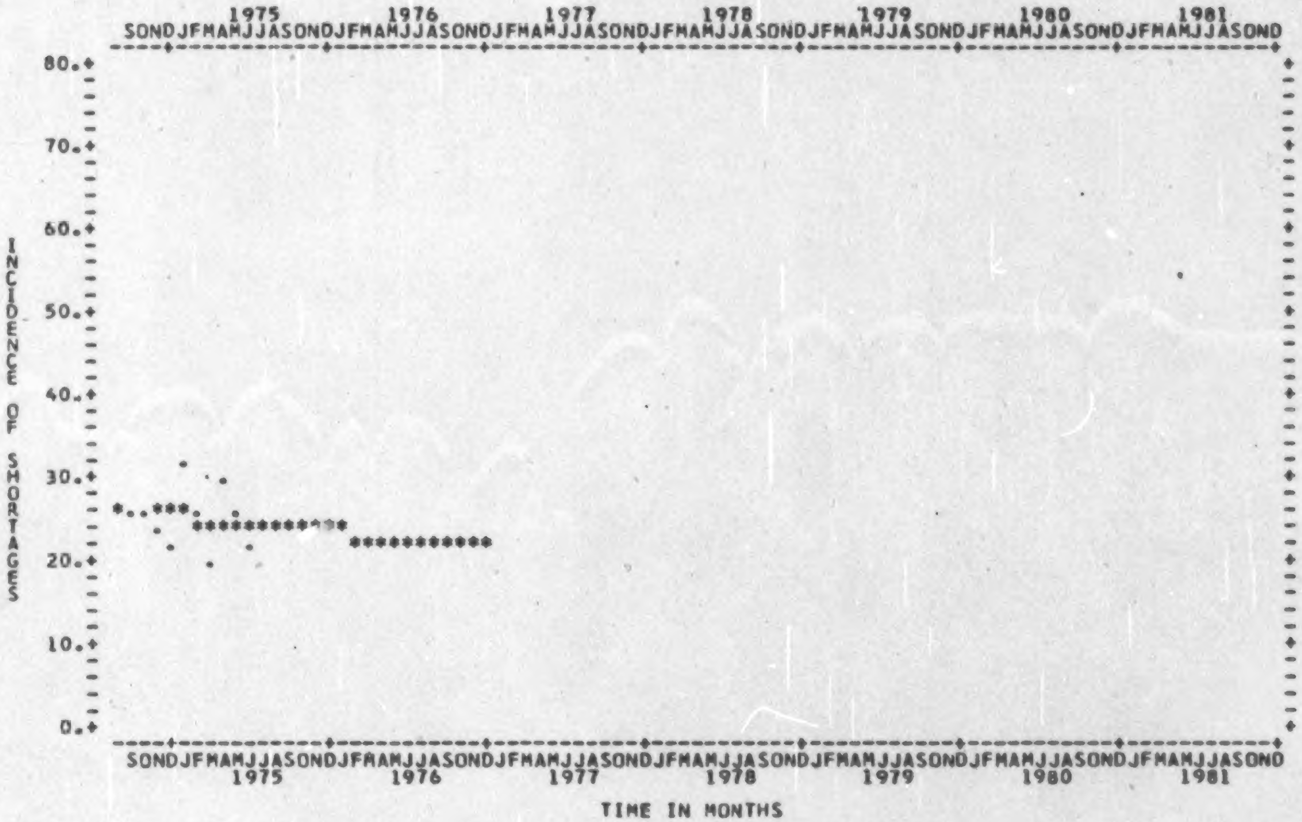
```
LEAST SQUARES TREND LINE     Y      =   4.2606 * (X) + 65.6667          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION   R      =   0.6659                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE   S(Y.X)=   13.7
STANDARD DEVIATION OF Y      S(Y)   =   18.4
COVARIANCE OF X AND Y        S(XY)  =   35.1
```

```
WELDING CLUSTER (TEC DATA)                    06/09/75
```



```
LEAST SQUARES TREND LINE      Y      =   0.4109 * (X) +  7.4770          . = HISTORY OF DATA
COEFFICIENT OF CORRELATION    R      =   0.7601                          * = CALCULATED DATA
STANDARD ERROR OF ESTIMATE    S(Y.X)=    6.3
STANDARD DEVIATION OF Y       S(Y)   =   9.7
COVARIANCE OF X AND Y         S(XY) = 131.6
```

WELDING (CLASSIFIED WANT-ADS DATA)   08/01/75



```
LEAST SQUARES TREND LINE     Y      =  -0.1697 * (X) + 25.9333        .  = HISTORY OF DATA
COEFFICIENT OF CORRELATION   R      =  -0.1419                        *  = CALCULATED DATA
STANDARD ERROR OF ESTIMATE   S(Y.X)=    3.4
STANDARD DEVIATION OF Y      S(Y)   =   3.4
COVARIANCE OF X AND Y        S(XY)  =  -1.4
```

APPENDIX B.

COMPUTER PROGRAM LISTING

```
                      DISK OPERATING SYSTEM/360 FORTRAN   360N-FO-451  CL 3-9
C
C** TEC DATA PLOT ONLY *****
C
C     PROGRAM LSTSOPL (INPUT,OUTPUT,TAPE 2 = INPUT, TAPE 3 = OUTPUT)
C          LEAST SQUARES LINE WITH GIVEN AND COMPUTED VALUES PRINTED
      EXTERNAL FUNCT
      DIMENSION TITLE(20), X(72), Y(72,8), SUMY(8), SUMXY(8), SUMYY(8),
     1      YBAR(8), SIGMA(8), COVAR(8)
    5 FORMAT(///  16X,'LEAST SQUARES TREND LINE'
     X 5X,'Y      =',F9.4,' * (X) +',F8.4,15X,'.  = HISTORY OF DATA'
     1 /16X,'COEFFICIENT OF CORRELATION   R      =',F9.4,
     2      31X,'*  = CALCULATED DATA'
     3 /16X,'STANDARD ERROR OF ESTIMATE   S(Y.X)=',F6.1
     4 /16X,'STANDARD DEVIATION OF Y      S(Y)  =',F6.1
     5 /16X,'COVARIANCE OF X AND Y        S(XY) =',F6.1//)
    7 FORMAT(10X,'X',11X,'Y',6X,'COMPUTED Y'/)
    8 FORMAT(1X,2F12.1,F12.3)
 1000 FORMAT(20A4)
 2000 FORMAT(26F3.0)
 3000 FORMAT(1H1,20X,20A4//)
 4000 FORMAT(2I3,A4)
 5000 FORMAT(1H1)
      BLANK=0
    1 READ (1,1000)(TITLE(I),I=1,20)
      IF (TITLE(20) - BLANK) 900,901,900
  900 WRITE(3,3000)(TITLE(I),I=1,20)
      READ(1,4000)NP,NC,BLANK
      N=NP
      NY=NC
      DO 100 I=1,NP
      X(I)=I
  100 CONTINUE
      READ (1,2000)((Y(K,J),K=1,NP),J=1,NY)
C          INITIALIZE SUMS
      SUMX = 0.
      SUMXX = 0.
      DU 31 J = 1, NY
      SUMY(J) = 0.
      SUMYY(J)=0.
   31 SUMXY(J) = 0.
C          ACCUMULATE SUMS
      DO 200 J=1,NY
      DO 200 K=1,NP
      SUMX = SUMX & X(K)
      SUMXX = SUMXX & X(K) * X(K)
      SUMXY(J) = SUMXY(J) & X(K)* Y(K,J)
      SUMYY(J) = SJMYY(J) & Y(K,J) * Y (K,J)
      SUMY(J) = SUMY(J) & Y(K,J)
  200 CONTINUE
      XBAR=SUMX/N
      DU 210 J=1,NY
      YBAR(J)=SUMY(J)/N
      SDYSQ=0.
      SDXDY=0.
      DO 220 K=1,NP
      SDYSQ=SDYSQ+(Y(K,J)-YBAR(J))**2
      SDXDY=SDXDY+(X(K)-XBAR)*(Y(K,J)-YBAR(J))
  220 CONTINUE
```

```
07/10/75           FORTMAIN                                             0002
      SIGMA(J)=SQRT(SDYSQ/N)
      COVAR(J)=SDXDY/N
  210 CONTINUE
C         COMPUTE COEFFICIENTS
   12 D = N * SUMXX - SUMX * SUMX
      DO 36 J = 1, NY
      R=(SUMXY(J)-((SUMX*SUMY(J))/N))/
     1SQRT((SUMXX-((SUMX*SUMX)/N))*
     2(SUMYY(J)-((SUMY(J)*SUMY(J))/N)))
      A = (SUMX * SUMY(J) - N * SUMXY(J))/ (-D)
      B = (SUMXX * SUMY(J) - SUMX * SUMXY(J)) / D
      STANDE=SQRT((SUMYY(J)-B*SUMY(J)-A*SUMXY(J))/N)
      WRITE (3,7)
      K = 1
      YMAX=Y(1,J)
   15 YC = A * X(K) & B
      WRITE (3,8) X(K), Y(K,J), YC
      IF (Y(K,J)-YMAX)700,700,710
  710 YMAX=Y(K,J)
  700 K=K+1
      IF (K - N) 15, 15, 21
C         PLOT LINE
   21 DO 20 K = 1, N
      M = N & K
   20 X(M) = Y(K,J)
      WRITE(3,3000)(TITLE(I),I=1,20)
      IF (YMAX-40.)720,730,730
  720 YTOP=39.
      GO TO 770
  730 IF (YMAX-80.)740,750,750
  740 YTOP=79.
      GO TO 770
  750 IF (YMAX-120.)760,765,765
  760 YTOP=119.
      GO TO 770
  765 YTOP=YMAX+20.
  770 CALL PLOT(J, X, N, 2, 1, FUNCT, 82.0, 0., YTOP,0.,A,B)
      WRITE (3,5) A,B,R,STANDE,SIGMA(J),COVAR(J)
   36 CONTINUE
      GO TO 1
  901 CALL EXIT
      END
```

```
                   DISK OPERATING SYSTEM/360 FORTRAN   360N-FO-451  CL 3-9
      SUBROUTINE PLOT (NO,A,N,M,NFUNC,FUNC,XLAX,XLIN,YLAX,YLIN,AA,BB)
C     PURPOSE - TO PLOT A GRAPH WITH ONE INDEPENDENT VARIABLE AND UP
C     TO 9 DEPENDENT VARIABLES, WITH THE ADDITIONAL ABILITY TO PLOT A
C     CALCULATED CURVE. THE INDEPENDENT VARIABLE IS PLOTTED ON A
C     HORIZONTAL AXIS, THE DEPENDENT ONES ON A VERTICAL AXIS. WIDTH
C     IS 100 PRINT POSITIONS, HEIGHT IS 50. EVERY POINT OF EACH
C     DEPENDENT VARIABLE IS INDICATED BY A NUMBER (1-9), WHILE THE
C     CALCULATED POINTS ARE DENOTED BY ASTERISKS.
C     PARAMETER USAGE.
C         NO   A FIXED POINT NUMBER, UP TO 3 DIGITS, PRINTED AS THE
C              CHART NUMBER
C         A    A VECTOR WHOSE FIRST N POSITIONS CONTAIN THE INDEPENDENT
C              VARIABLE, AND WHOSE NEXT M SETS OF N POSITIONS CONTAIN
C              THE DEPENDENT VARIABLES
C         N    NUMBER OF OBSERVATIONS
C         M    NUMBER OF VARIABLES (INDEPENDENT & DEPENDENT)
C         NFUNC GREATER THAN ZERO IF A CALCULATED CURVE IS TO BE
C              PRINTED
C         FUNC SUBROUTINE TO GENERATE CALCULATED CURVE. IF ONE WANTED.
C              ELSE IS A DUMMY. PROGRAM CALLING PLOT MUST HAVE AN
C              'EXTERNAL FUNC'. SUBROUTINE CALLED BY CALL FUNC (X,Y),
C              WHERE X IS GIVEN TO SUBROUTINE AND Y RETURNED.
C         XLAX,XLIN,YLAX,YLIN  MAXIMUM AND MINIMUM VALUES OF THE
C              INDEPENDENT AND DEPENDENT VARIABLES TO BE USED IN THE
C              PLOT IF XLAX = XLIN, THE PROGRAM CALCULATES ITS OWN
C              MAXIMUM AND MINIMUM FOR THE INDEPENDENT VARIABLE.
C              SIMILARLY FOR YLAX = YLIN
C     REQUIRED SUBROUTINES. FUNC (IF USED), AND SCAL.
C     CALC IS 1 LARGER THAN NEEDED IN CASE XMIN & 100*XSCAL
C     SHOULD BE LARGER THAN XMAX.  THIS PREVENTS SLOPOOVER INTO
C     NEXT LOCATION.        LOOK AROUND CARD =950 TO SEE WHAT I MEAN.
C     CALC IS WHERE CALCULATED FUNCTION GOES.
      DIMENSION IOUT(101),XPR(11),A(1),CALC(102)
      DIMENSION KAR(11),YLABIN(40),YLABEL(100)
      EQUIVALENCE (IOUT(1), XPR(1))
      READ (1,1000)(KAR(I), I=1,11)
      READ(1,3000)(YLABIN(I),I=1,40)
      DO 700 I=1,100
      YLABEL(I)=YLABIN(40)
  700 CONTINUE
      DO 710 I=1,40
      YLABEL(I+10)=YLABIN(I)
  710  CONTINUE
    1 FORMAT (1H , 60X, 7H CHART , I3)
    2 FORMAT (1H ,6X,A1,1X,F4.0,'+ ',95A1,2A1, '+')
    7 FORMAT (1H ,14X,8('+-----------'),'+')
    8 FORMAT(1H0,6X,11F10.0)
  118 FORMAT (1H ,6X,A1,5X,2H- ,95A1,2A1,'-')
 1000 FORMAT (11A4)
 2000 FORMAT (1H ,15X,8('JFMAMJJASOND'))
 2001 FORMAT (1H ,19X,'1970',8X,'1971',8X,'1972',8X,'1973',
     1              8X,'1974',8X,'1975',8X,'1976',8X,'1977')
 2002 FORMAT (1H0)
 2003 FORMAT (1H1)
 2005 FORMAT(1H0,51X,'T.ME IN MONTHS')
 3000 FORMAT(40A1)
C     PRINT CHART NO.
C     WRITE (3,1) NO
```

```
      ICOUNT = 4
      LCOUNT=1
C     IF NO EXTREMES OF X GIVEN, FIND THEM
      IF (XLAX - XLIN) 20,10,20
   10 XMIN = A(1)
      XMAX = XMIN
      DO 15 J = 1,N
      IF (A(J) - XMIN) 11,12,12
   12 IF (A(J) - XMAX) 15,15,14
   11 XMIN = A(J)
      GO TO 15
   14 XMAX = A(J)
   15 CONTINUE
      GO TO 202
   20 XMAX=XLAX
      XMIN=XLIN
C     CALCULATE RAW SCALE SIZE
  202 XSCAL=(XMAX-XMIN)/100.
C     ROUTINE TO CALCULATE EXACT SCALE SIZE AND END POINTS
      CALL SCAL (XSCAL,XMAX,XMIN)
C     IF NO EXTREMES OF Y GIVEN, FIND THEM
      IF (YLAX - YLIN) 110,112,110
  112 L  = N & 1
      YMIN = A(L)
      YMAX=YMIN
      LL = M*N
      DU 40 J = L,LL
      IF(A(J)-YMIN) 28,26,26
   26 IF(A(J)-YMAX) 40,40,30
   28 YMIN=A(J)
      GO TO 40
   30 YMAX=A(J)
   40 CONTINUE
      GO TO 201
  110 YMAX=YLAX
      YMIN=YLIN
C     GET SCALE SIZE AND END POINTS
  201 YSCAL = (YMAX - YMIN ) / 50.
      CALL SCAL (YSCAL,YMAX,YMIN)
C     PRINT TOP SCALE
      XPR(1) = XMIN
      DO 200 JP=1,10
      XPR(JP&1) = XPR(JP) & XSCAL * 10.
C     TO MAKE SURE THAT ZERO REALLY PRINTS AS ZERO, NOT A SMALL NUMBER
C         CAUSED BY ROUNGING ERRORS.
      IF (ABS(XPR(JP&1) - .5 * XSCAL)) 240,240,200
  240 XPR(JP&1) = 0.
  200 CONTINUE
C
      WRITE (3,8) (XPR(JP),JP=1,11)
      WRITE (3,2002)
      WRITE (3,2001)
      WRITE (3,2000)
      WRITE (3,7)
C     IF CALCULATED CURVE WANTED GET VALUES BETWEEN XMIN AND XMAX
      IF (NFUNC) 210,210,211
  211 F = XMIN
      JP = 1
  213  CALL FUNC (F, CALC(JP),AA,BB)
```

```
      IF (F - XMAX) 212,210,210
  212 F = F & XSCAL
      JP = JP & 1
      GO TO 213
  210 CONTINUE
C     START PRINT AT MAXIMUM Y
      YPR = YMAX
C     CLEAR PRINT LINE
  230 DO 55 JP = 1,101
   55 IOUT(JP) = KAR(1)
C     IF CALCULATED CURVE WANTED SET UP POINTS
      IF (NFUNC) 214,214,215
  215 F = XMIN
C     SCAN ALL VALUES OF Y FOR X BETWEEN XMIN AND XMAX
      JP = 1
C     IS POINT WITHIN HALF A SCALE OF PRINT POSITION
  220 IF (ABS(YPR-CALC(JP)) - .5 * YSCAL) 216,217,218
C     IF EXACTLY  BETWEEN PRINT POSITIONS ONLY PRINT IT ONCE
  217 IF (YPR - CALC (JP)) 218,216,216
C     BELIEVE IT OR NOT THIS IS AN ASTERISK (NUMBER TOO LARGE TO WRITE
C. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  216 IOUT(JP) = KAR(11)
  218 IF (F - XMAX) 219,214,214
  219 JP = JP &1
      F = F & XSCAL
      GO TO 220
C     RUN DOWN EACH SET OF DEPENDENT VARIABLES
C     IF NO POINTS WANTED
  214 IF (N) 70,70,300
  300 DO 221 J = 2,M
      DO 222 L = 1,N
C     CALCULATE SUBSCRIPT FOR A
      LL = (J - 1) * N & L
C     IS IT WITHIN HALF A SCALE OF PRINT POSITION
      IF (ABS(YPR - A(LL)) - .5 * YSCAL) 223,224,225
C     IF EXACTLY HALFWAY BETWEEN, PRINT ONLY ONCE
  224 IF (YPR - A(LL)) 225,223,223
C     FIND HORIZONTAL POSITION
  223 JP = (A(L) -XMIN) / XSCAL & 1.5
C     IF OFF GRAPH, FORGET IT
      IF (JP - 1) 225,226,226
  226 IF (JP - 101) 227,227,225
C     THIS GIVES 1,2,3 ETC. FOR J=2,3,4 ETC
C. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  227 IOUT (JP) = KAR (J)
  225 CONTINUE
  222 CONTINUE
  221 CONTINUE
   70 ICOUNT = ICOUNT &1
C     PRINT VALUE ON VERTICAL AXIS EVERY FIVE POSITIONS
      IF (ICOUNT - 5) 120,119,120
  120 WRITE (3,118)YLABEL(LCOUNT),(IOUT(JP),JP=1,97)
      LCOUNT=LCOUNT+1
      GO TO 80
C     MAKE ZERO PRINT AS ZERO, NOT SMALL NUMBER
  119 IF (ABS(YPR )-.5 * YSCAL)  232,232,233
  232 F= 0.
      GO TO 234
  233 F = YPR
  234 WRITE (3,2)YLABEL(LCOUNT),F,(IOUT(JP),JP=1,97)
      LCOUNT=LCOUNT+1
      ICOUNT = 0
C     IF REACHED YMIN, STOP
   80 IF (YPR - YMIN) 86,86,45
C     ELSE DECREMENT Y
   45 YPR = YPR - YSCAL
      GO TO 230
   86 WRITE (3,7)
C     PRINT BOTTOM SCALE
      XPR(1) = XMIN
      DO 90 JP =1,10
      XPR(JP&1)=XPR(JP)&XSCAL*10.
      IF (ABS(XPR(JP&1) - .5*XSCAL)) 231,231,90
  231 XPR(JP&1) = 0.
   90 CONTINUE
C     WRITE (3,8) (XPR(JP),JP=1,11)
      WRITE (3,2000)
      WRITE (3,2001)
      WRITE (3,2005)
      RETURN
      END
```

```
                    DISK OPERATING SYSTEM/360 FORTRAN   360N-FO-451  CL 3-9

      SUBROUTINE SCAL (XSCAL,XMAX,XMIN)
C     PURPOSE. GIVEN RAW SCALE AND END POINTS, GET ROUNDED VALUES.
      F=ALOG10(XSCAL)
C     FIND NEXT LOWEST POWER OF 10.
      IF (F) 1,2,2
C     IF NEGATIVE, STOP FORTRAN FROM ROUNDING UP
    1 JP=F-1
      GO TO 20
    2 JP=F
C     FIND VALUE JUST LARGER THAN TAW YSCAL, OF FORM 1,2,2.5,2,OR 10
C         TIMES 10 TO AN INTEGRAL POWER
   20 F=10.**JP
    6 IF (F-XSCAL) 3,4,4
    3 F=F&F
      IF (F-XSCAL) 5,4,4
    5 F=1.25*F
      IF (F-XSCAL) 7,4,4
    7 F=F&F
      IF (F-XSCAL) 30,4,4
   30 F=F&F
      GO TO 6
C     SET EQUAL TO SCALE
    4 XSCAL=F
      JP=XMAX/XSCAL
C     MAKE END POINTS INTEGRAL MULTIPLES OF SCALE
   12 F=JP*XSCAL
      IF (F-XMAX) 10,11,11
   10 JP=JP&1
      GO TO 12
   11 XMAX=F
      JP=XMIN/XSCAL
   13 F=JP*XSCAL
      IF (F-XMIN) 14,14,15
   15 JP=JP-1
      GO TO 13
   14 XMIN = F
      RETURN
      END
```

```
                    DISK OPERATING SYSTEM/360 FORTRAN   360N-FO-451  CL 3-9

      SUBROUTINE FUNCT(X,Y,A,B)
      Y=A*X+B
      RETURN
      END
```

```
                     DISK OPERATING SYSTEM/360 FORTRAN   360N-FO-451   CL 3-9
      SUBROUTINE PLOT (NO,A,N,M,NFUNC,FUNC,XLAX,XLIN,YLAX,YLIN,AA,BB)
C     PURPOSE - TO PLOT A GRAPH WITH ONE INDEPENDENT VARIABLE AND UP
C     TO 9 DEPENDENT VARIABLES, WITH THE ADDITIONAL ABILITY TO PLOT A
C     CALCULATED CURVE. THE INDEPENDENT VARIABLE IS PLOTTED ON A
C     HORIZONTAL AXIS, THE DEPENDENT ONES ON A VERTICAL AXIS. WIDTH
C     IS 100 PRINT POSITIONS, HEIGHT IS 50. EVERY POINT OF EACH
C     DEPENDENT VARIABLE IS INDICATED BY A NUMBER (1-9), WHILE THE
C     CALCULATED POINTS ARE DENOTED BY ASTERISKS.
C     PARAMETER USAGE.
C        NO    A FIXED POINT NUMBER, UP TO 3 DIGITS, PRINTED AS THE
C              CHART NUMBER
C        A     A VECTOR WHOSE FIRST N POSITIONS CONTAIN THE INDEPENDENT
C              VARIABLE, AND WHOSE NEXT M SETS OF N POSITIONS CONTAIN
C              THE DEPENDENT VARIABLES
C        N     NUMBER OF OBSERVATIONS
C        M     NUMBER OF VARIABLES (INDEPENDENT & DEPENDENT)
C        NFUNC GREATER THAN ZERO IF A CALCULATED CURVE IS TO BE
C              PRINTED
C        FUNC  SUBROUTINE TO GENERATE CALCULATED CURVE. IF ONE WANTED.
C              ELSE IS A DUMMY. PROGRAM CALLING PLOT MUST HAVE AN
C              'EXTERNAL FUNC'. SUBROUTINE CALLED BY CALL FUNC (X,Y),
C              WHERE X IS GIVEN TO SUBROUTINE AND Y RETURNED.
C        XLAX,XLIN,YLAX,YLIN  MAXIMUM AND MINIMUM VALUES OF THE
C              INDEPENDENT AND DEPENDENT VARIABLES TO BE USED IN THE
C              PLOT IF XLAX = XLIN, THE PROGRAM CALCULATES ITS OWN
C              MAXIMUM AND MINIMUM FOR THE INDEPENDENT VARIABLE.
C              SIMILARLY FOR YLAX = YLIN
C     REQUIRED SUBROUTINES. FUNC (IF USED), AND SCAL.
C     CALC IS 1 LARGER THAN NEEDED IN CASE XMIN & 100*XSCAL
C     SHOULD BE LARGER THAN XMAX.  THIS PREVENTS SLOPOOVER INTO
C     NEXT LOCATION.       LOOK AROUND CARD =950 TO SEE WHAT I MEAN.
C     CALC IS WHERE CALCULATED FUNCTION GOES.
      DIMENSION IOUT(101),XPR(11),A(1),CALC(102)
      DIMENSION KAR(11),YLABIN(40),YLABEL(100)
      EQUIVALENCE (IOUT(1), XPR(1))
      READ (1,1000)(KAR(I), I=1,11)
      READ(1,3000)(YLABIN(I),I=1,40)
      DO 700 I=1,100
      YLABEL(I)=YLABIN(40)
  700 CONTINUE
      DO 710 I=1,40
      YLABEL(I+10)=YLABIN(I)
  710  CONTINUE
    1 FORMAT (1H , 60X, 7H CHART , I3)
    2 FORMAT (1H ,6X,A1,1X,F4.0,'+ ',95A1,2A1, '+')
    7 FORMAT (1H ,14X,8('+------------'),'+')
    8 FORMAT(1H0,6X,11F10.0)
  118 FORMAT (1H ,6X,A1,5X,2H- ,95A1,2A1,'-')
 1000 FORMAT (11A4)
 2000 FORMAT (1H ,15X,8('JFMAMJJASOND'))
 2001 FORMAT (1H ,19X,'1970',8X,'1971',8X,'1972',8X,'1973',
     1              8X,'1974',8X,'1975',8X,'1976',8X,'1977')
 2002 FORMAT (1H0)
 2003 FORMAT (1H1)
 2005 FORMAT(1H0,51X,'TIME IN MONTHS')
 3000 FORMAT(40A1)
C     PRINT CHART NO.
C     WRITE (3,1) NO
```

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